ANNUAL REVIEW NUMBER

The CHEMICAL AGE

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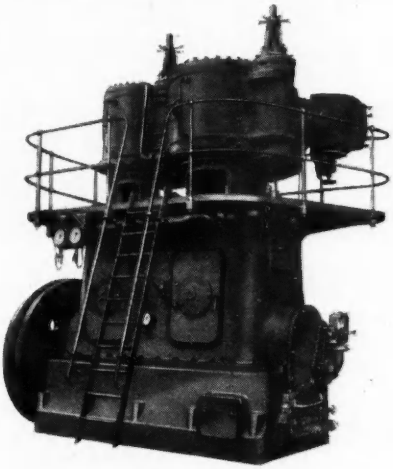

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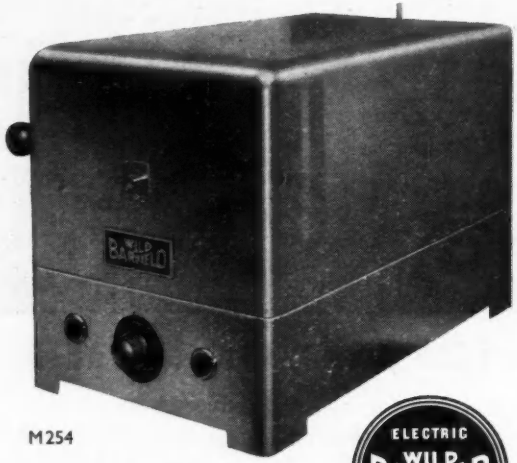

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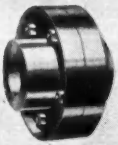

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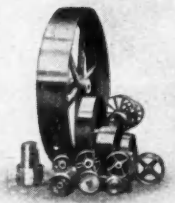

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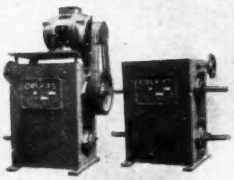

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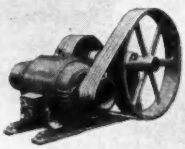

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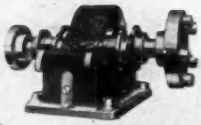

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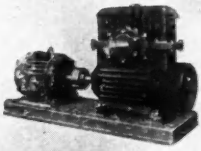

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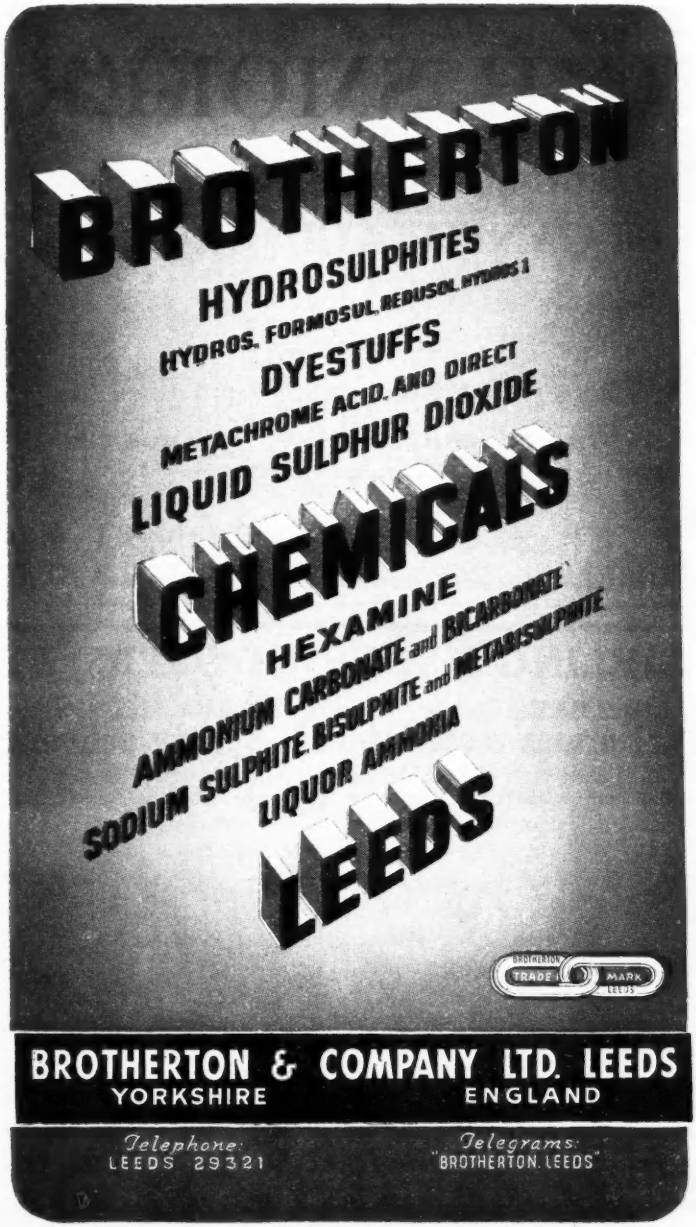
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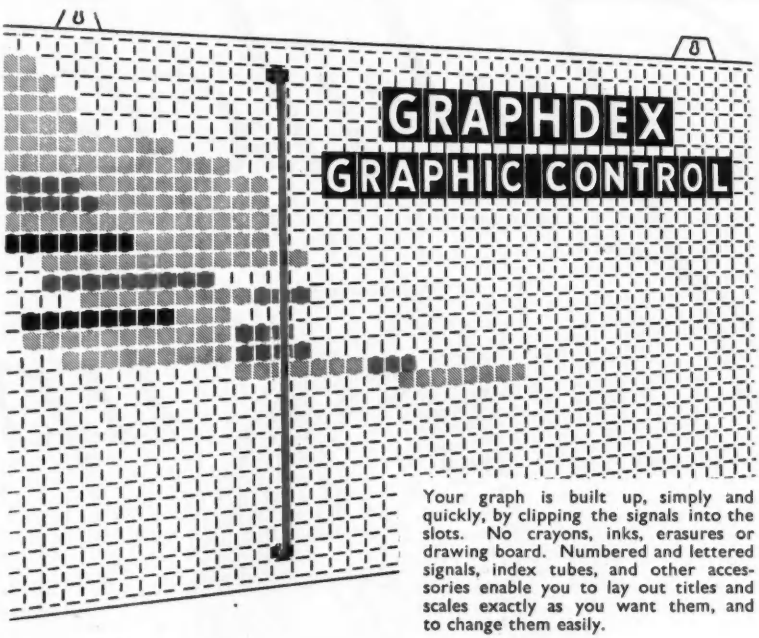

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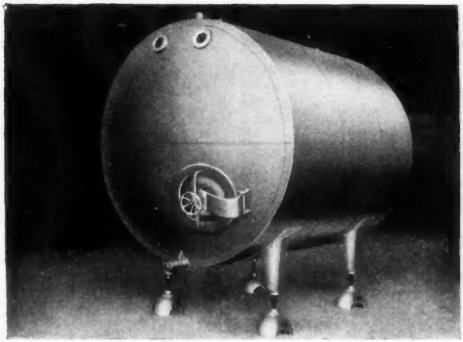

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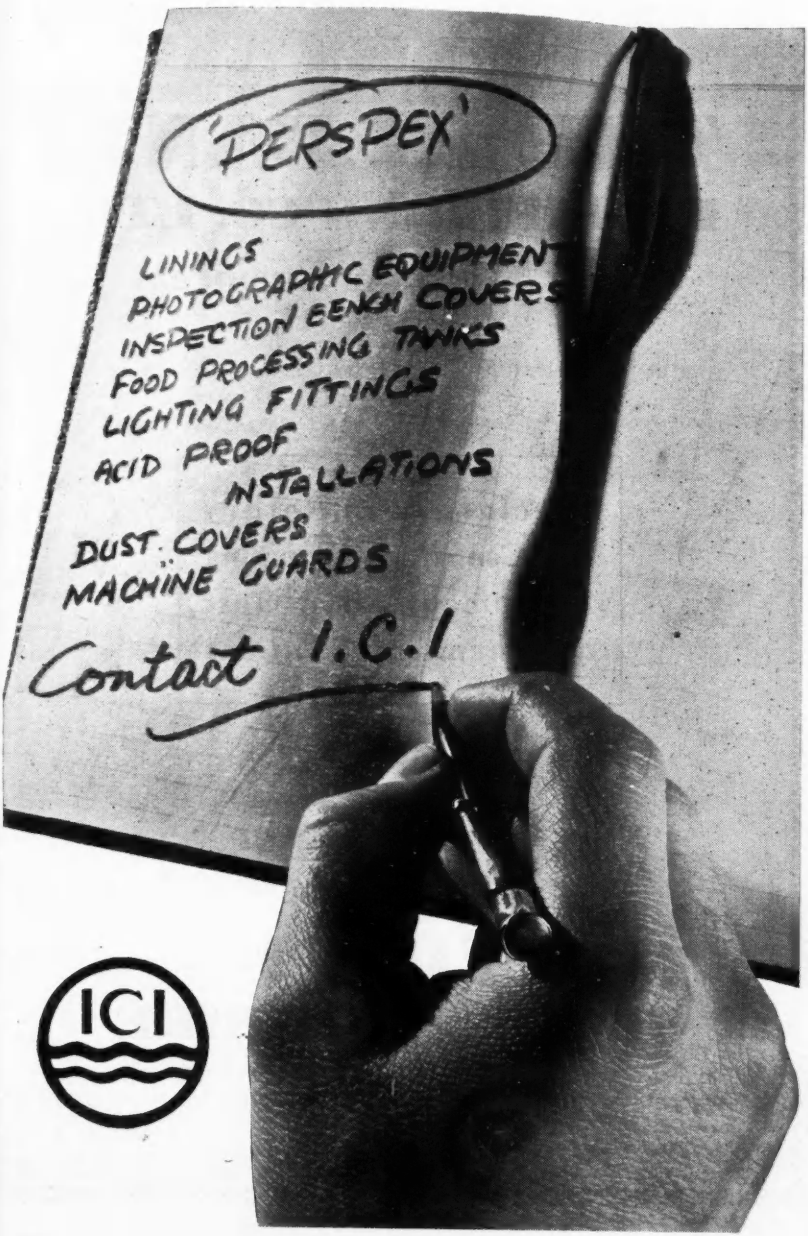
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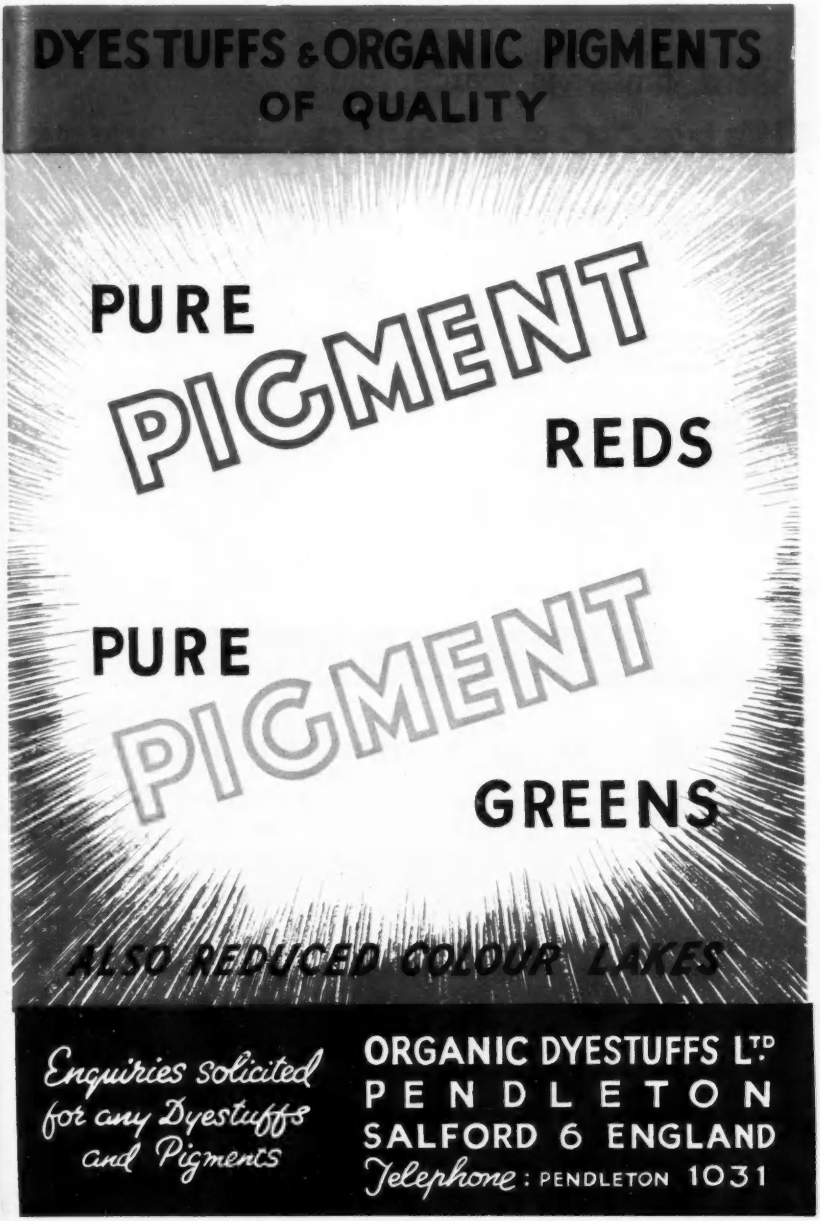
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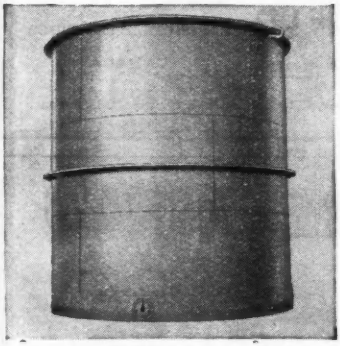

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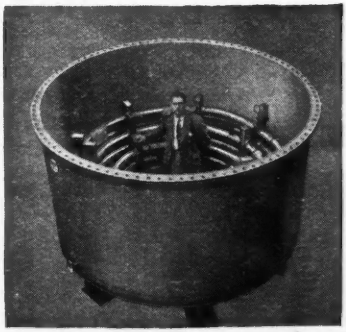

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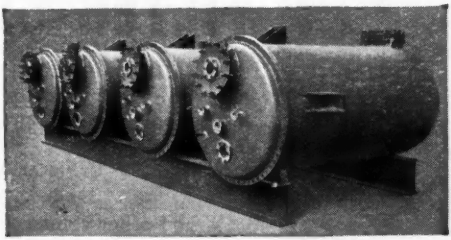

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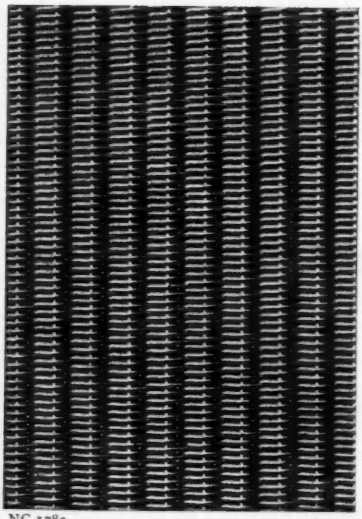

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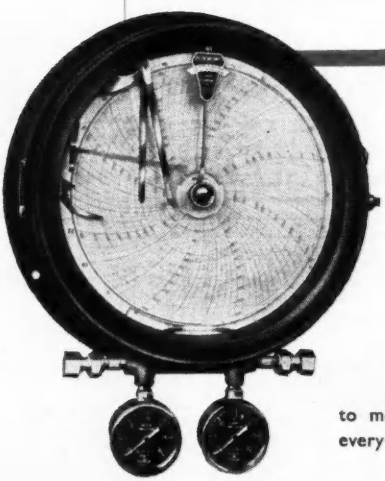

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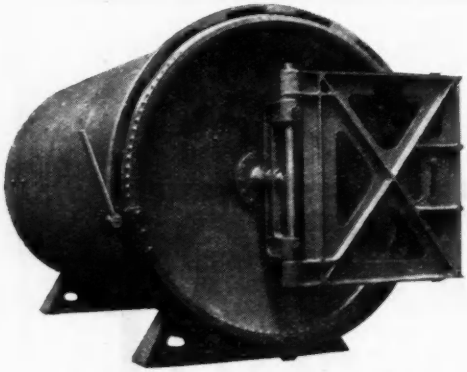

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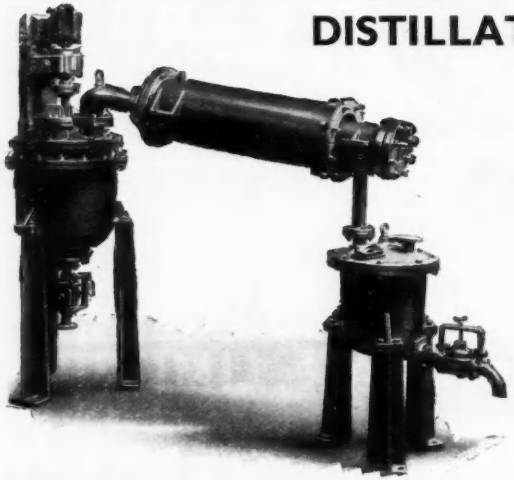

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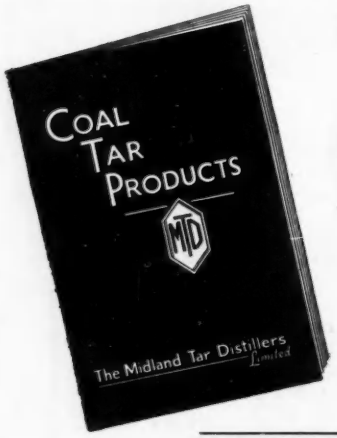

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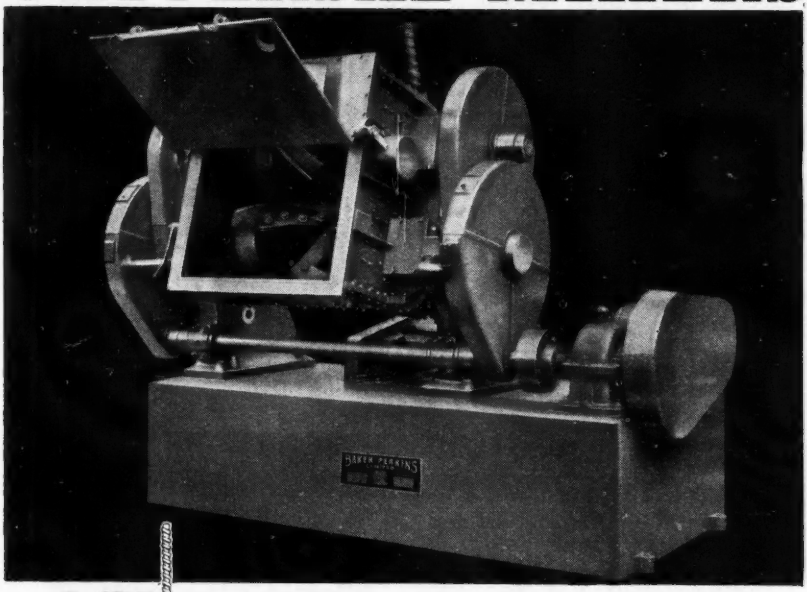

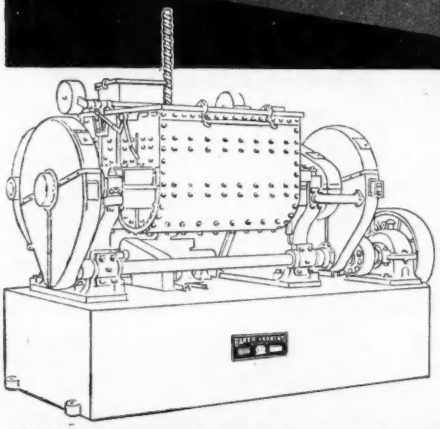

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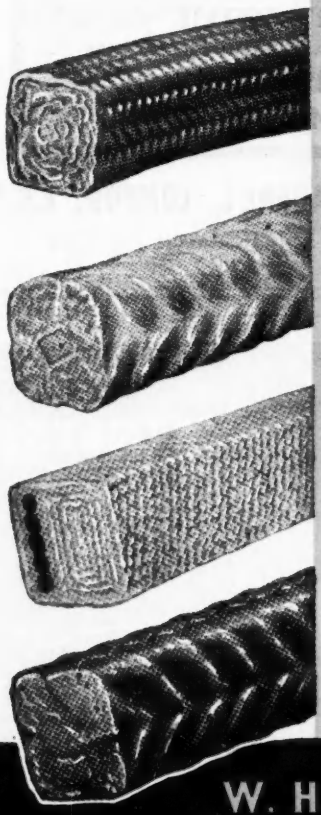

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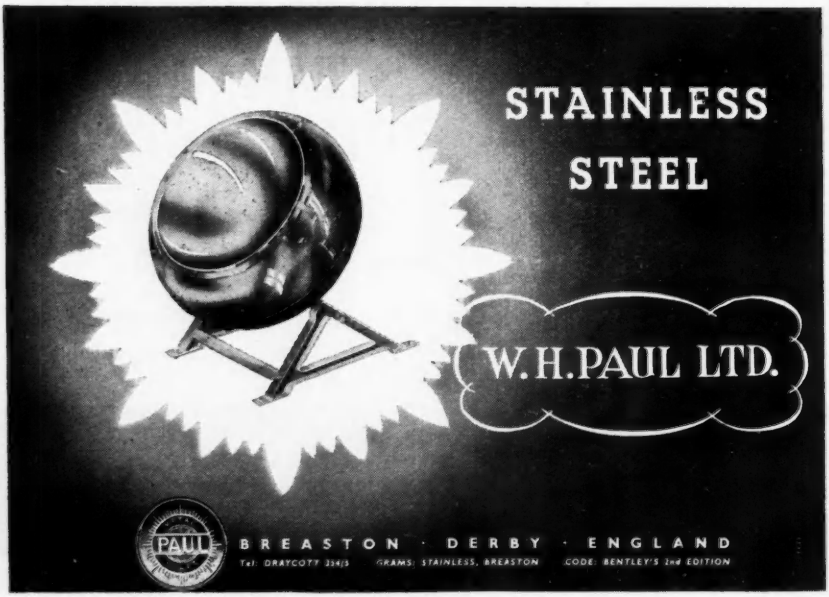

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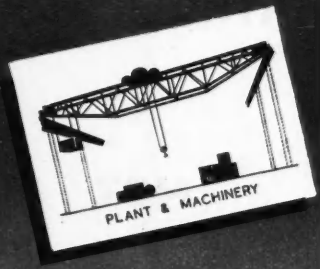

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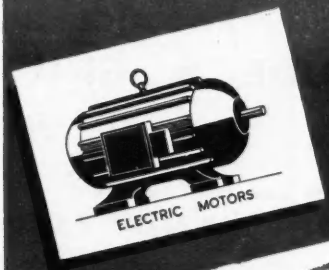

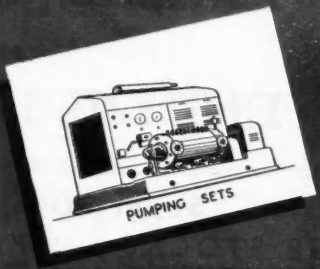

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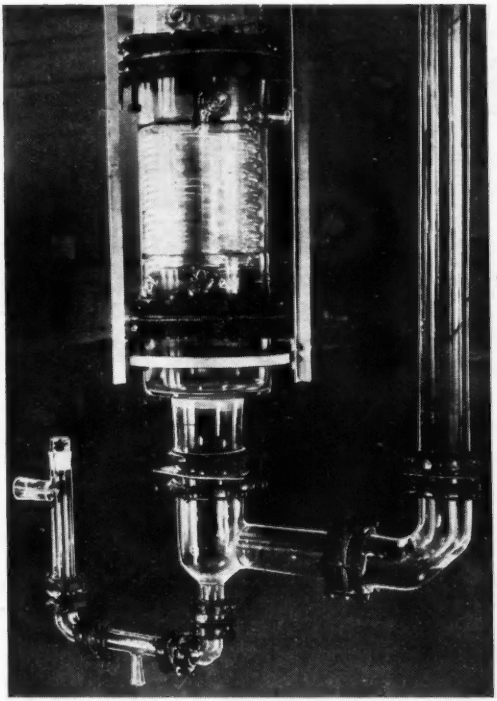

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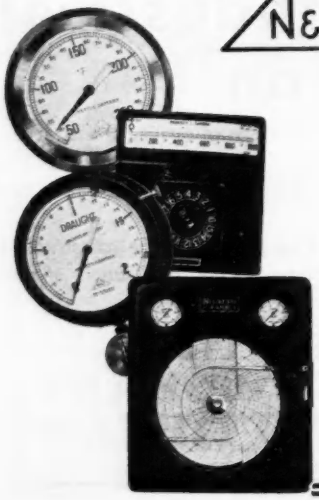

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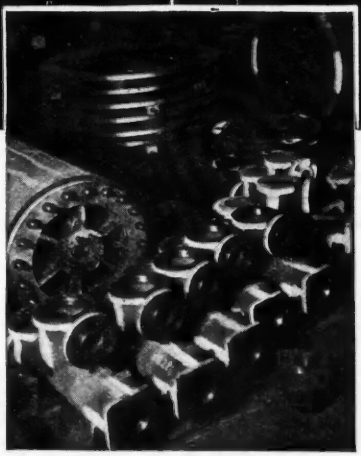

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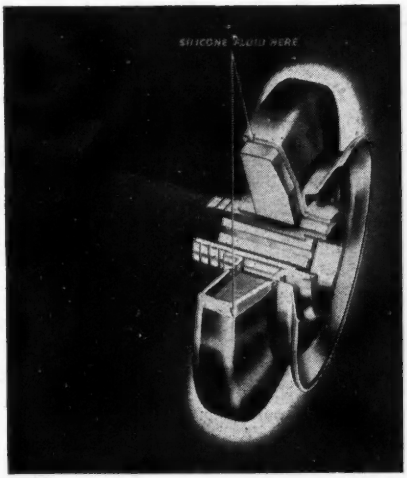

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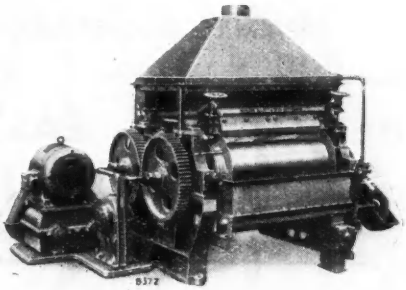

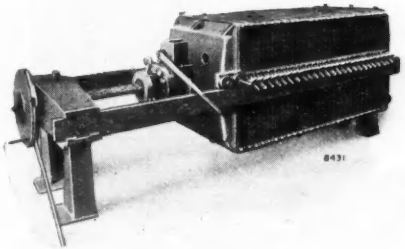

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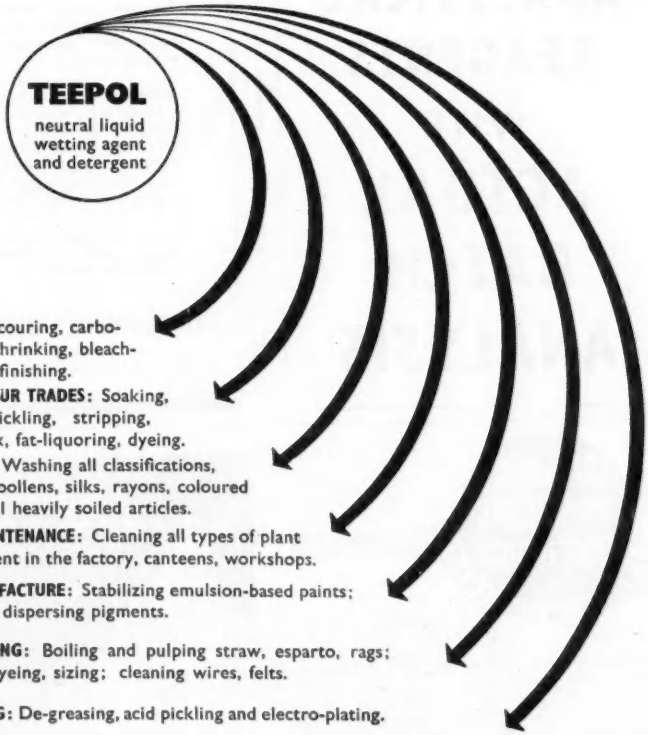

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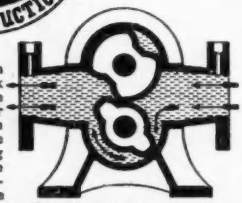

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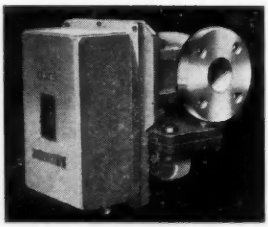

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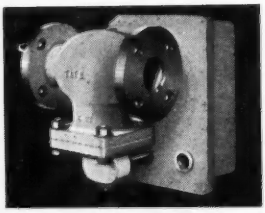

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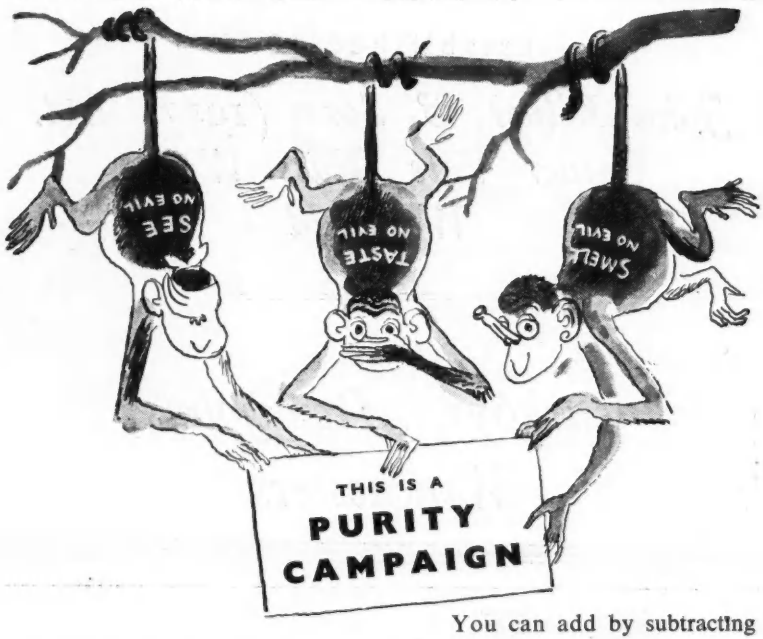

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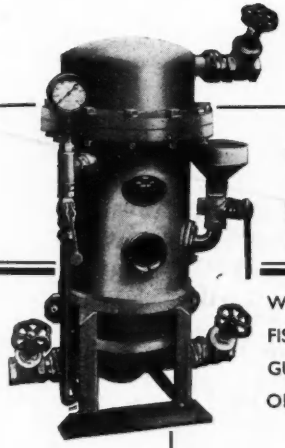

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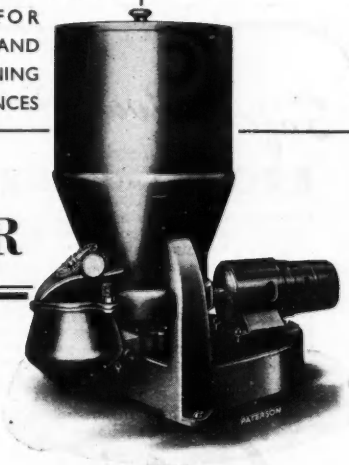

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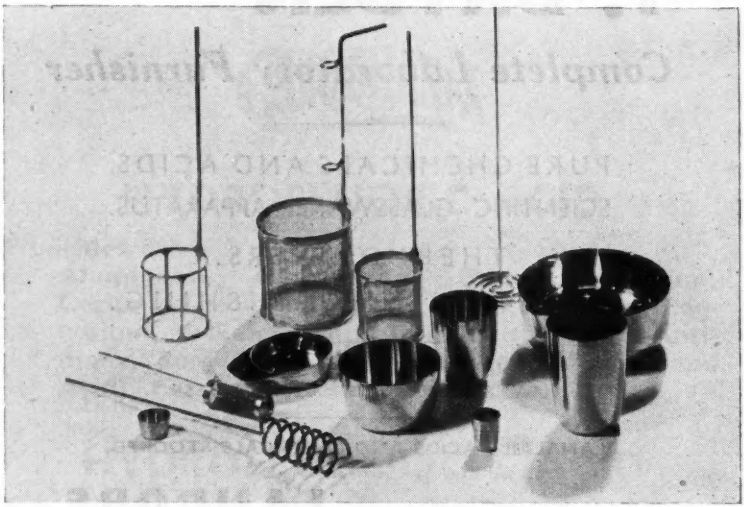

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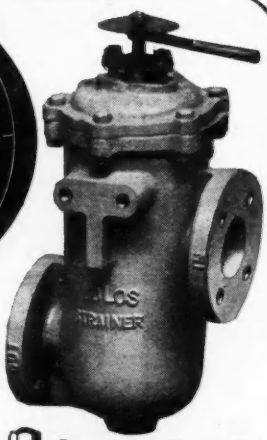

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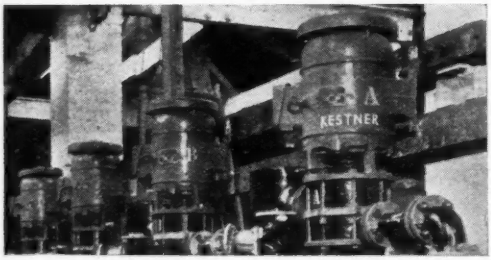

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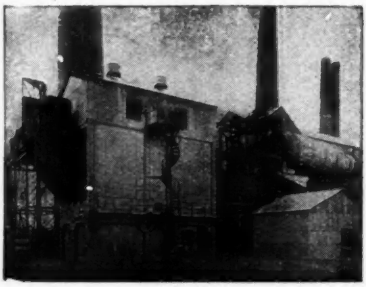

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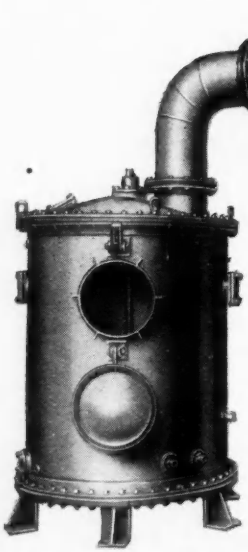

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VOL. LX
No. 1539.

8 January 1949

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Portents for 1949

IN this substantially enlarged number, THE CHEMICAL AGE has given currency once more to the well established custom of reviewing some at least of the chains of influences and events which have helped to shape the course of several important departments of chemical industry. Because of the extraordinary diversity of activities which owe their inspiration to chemistry and derive from it almost every advance they make, any such review within present limited conditions of publishing can cover only a small part of the field coming within the scope of organic and inorganic chemistry. The problem of selecting within that wide field was never easy: now, to present a balanced picture of the whole is virtually impossible. That fact is a direct reflection of the almost unparalleled growth which has taken place in the industrial utilisation of chemical science and technology.

The year has been, more than any of its predecessors, a time of transition from the narrow objectives imposed by the need for intense specialisation throughout the war to comparative freedom to elaborate new methods of production and new materials. That process admittedly did not originate in 1948, but in no other year have the effects been so fully apparent. The contributions which have been made by the biochemical laboratories alone are sufficiently impressive to sustain 1948's reputation as a period of almost unequalled fruition of projects with which the laboratories have been concerned since the necessity to direct all their efforts to serve the requirements of Service departments began to relax. There is, of course, ample evidence, although very much less widely presented, that the achievements in several departments of heavy chemical production and the technology of metals have been of equally imposing proportions. And in most of these fields it is significant that these have been the early fruition of research projects of which the results in the future are likely to be not less stimulating. Notwithstanding the assertion frequently made in the past year that the research laboratories are undermanned, the evidence presented by industry does not provide any immediate confirmation, and the quality of some recent achievements indicates that research teams are animated by all the courage and questing spirit from which have come all our greatest industrial advances in the past.

Were the foregoing facts all that needed to be considered the uncertainty that is felt about the industrial future could be discounted. It is, however, unfortunately true that not even science and the most enterprising technology can yield anything like a commensurate return if industries with which they are linked are haltered by scarcities, whether they be of fuel and materials, steel, capital or freedom to set their own courses. 1948 has fortunately seen a great reduction of the fuel shortages which crippled enterprise a year before;

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materials, with some conspicuous exceptions, have flowed rather more freely, and while inability to make steel available in reasonable quantity has been the reason for long delays in securing new buildings and chemical machinery, the splendid records of the steelworks hold promise of temporary relief.

Conditions might fairly be said to favour a great measure of expansion in the coming months, of which the very large development schemes in the past year by groups such as Shell, the Manchester Oil Refineries, I.C.I., Ltd., and Laporte Chemicals have indicated the scope. Its prospects of being realised are dependent, however, upon the willingness of the Government to exhibit a spirit of partnership rather than of antagonism towards those leading the movement to secure full, profitable production.

All the elements of this uneasy situation were forcefully presented a few days ago by the chairman of Birmid Industries, Ltd., whose company's marked success, as a newcomer in the export market for light metals and components entitles him to a hearing.

"It is useless," said Mr. C. C. Maudslay, "to attack private enterprise one week, and next week call upon those whose substance and energy are employed therein for greater enterprise and effort. Yet this form of destructive fatuity is being constantly perpetrated, to the unsettlement of highly qualified and conscientious men carrying heavy responsibilities, in the discharge of which they have in mind the country's welfare quite as much as those who are more vocal on the subject.

"In the main, the public welfare is placed before private profit, which latter is in any case very thoroughly supervised by H.M. Treasury. Is it asking too much that all public men should set aside political prejudices in this grave crisis in our nation's affairs, and work for national unity, afford encouragement to those who lead and administer industry worthily and efficiently, and cease to give them the undeserved stigma of social or moral delinquency? With unity and wholehearted work all round, I am confident the nation can reach far greater heights than it has done, and thus we may 'save ourselves by our efforts, and Europe by our example.'"

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A FURTHER rise in the price of lead was reported on Monday, to take effect immediately. The increase, of £11 per ton, brings the rate for good quality soft pig lead to £123 per ton and the "English" grade of the metal to £124 10s.

An immediate reaction has been a general hardening of market values of all the lead derivates.

NOTES AND COMMENTS

Antrycide

IF the claims which have been made for the new drug Antrycide are fully borne out by the field trials in West Africa against trypanosomiasis in cattle British chemistry will have made a contribution to solving world wide problems greater than has latterly seemed possible. In view of the extreme caution with which any claims to produce " cures " are made and of the fact that experimental use in East Africa and the Sudan are said already to have shown that two of the worst forms of animal trypanosomiasis were cured by one injection of Antrycide there are no grounds for thinking that the profound potentialities of the drug have been overstated. In that case, chemists will have done much to justify the belief, which was received with enthusiasm a generation or so ago and has become considerably less popular since, that plentiful food supplies might be procured by the co-ordinated effort of the people in the laboratories. If Antrycide does in fact render fit for stock raising cultivable parts of 405 million square miles of tsetse-ridden Africa it will, of course, not have banished a tenth of the troubles which confront the international Food and Agricultural Organisation, but it will still represent the most productive advance in many years. The general public has on this occasion been told, if not the whole story of the development of " M7555 " from a mildly active preparation to a killer of trypanosomes, enough to excite profound respect for I.C.I.'s chemists and biologists at Manchester, who have now added possibly the most important veterinary drug to the antimalarial Paludrine. To have participated prominently in the discovery of both was the privilege of Dr. F. H. S. Curd and Dr. D. G. Davey, who lead the team working on the " M7555 " project. The death of the former amid the wreckage of the Stockport train last November represented a deeply tragic loss to chemistry.

Bleached Flour

JUST two years have passed since Sir Edward Mellanby called attention in the *British Medical Journal* to the somewhat disconcerting circumstance that the effect of keeping dogs on a diet of the artificially bleached " white " bread of the kind being eaten throughout the Kingdom to-day was to produce hysteria. This was a scientifically conducted test, in which the control animals, fed with unbleached flour, were unaffected, and it was reasonably concluded that the hysteria-producing element was the nitrogen trichloride, the use of which in fairly substantial proportions is officially sanctioned. The implications of that report, although no equivalent tests on people were carried out, was not disregarded here, but in the U.S.A., where the nitrogen compound is also used in flour, there was a very much stronger reaction, resulting in agitation which has now attained its end. From the middle of this year the use of that chemical for bleaching flour is to be prohibited by order of the U.S. Food and Drug Administration. Reporting this decision, *Chemical Industries* foresees that it will call for comparatively large changes in some chemical programmes. Bleach will, of course, still be permitted and chlorine dioxide is thought to be the most acceptable agent, although several other chlorine chemicals, nitrogen tetroxide and benzoyl peroxide have been mentioned as possible alternatives. The American organisation which looks forward to supplying all the chlorine dioxide that may be needed (the Wallace & Tiernan Company) is stated in the U.S. report to have secured concessions from the chlorine specialists, the Mathieson Chemical Corporation and new capital equipment costing the equivalent of some £500,000 is said to be required. The repercussions in America of his report—and the comparative indifference here—must seem distinctly odd to the author of the report.

Neglected Appeals

ARE chemists, as a professional group, more unresponsive than others to communal appeals. If they are—and there is some evidence to support the view in the annual report of the Royal Institute of Chemistry—they certainly have as good excuses as any other group of hardworking people with exacting responsibilities. That must account very largely for the discouraging result, which the RIC records, of its circulation of questionnaires to members. The first of these, about three years ago, asking what type of social event was preferred, was perhaps not calculated to

receive much attention from those with little or no time to give to group social events. Comparatively few replied, says the RIC. Only slightly better was the response to the institute's education questionnaire, no frivolous affair this, which was sent out in 1946 and followed up a year later. Only 5.7 per cent of the members and registered students to whom this double-barrelled discharge was directed sent replies. Voting for the election of officers and members of committee elicited a somewhat more lively interest: 17.6 per cent of members voted in 1947; 22.8 per cent in 1948. The peculiarity of this somewhat lukewarm interest of members is that a similar procedure used elsewhere by the RIC, to secure the views of 200 firms and institutions in Hertfordshire on an educational subject, brought replies from 62 per cent. That affords a curious contrast and seems to show that undertakings sponsored by the RIC are not generally regarded as unworthy of attention, except by a fairly large proportion of its own members.

Popular Club

TO compare the apparent fruits of attempts to organise chemists for their own good by two dissimilar organisations would be futile, especially when those bodies are on opposite sides of the Atlantic, yet it is worth noting that in New York the Chemist's Club, now celebrating the completion of its first half-century of existence, seems to have no trouble in evoking lively support and collaboration among American chemists. It has raised its membership by more than 450 to 2272 in the past five years. By English standards, the movement for collaboration among chemists in New York is almost a novelty. Until the American Chemical Society came to life some 70 years ago, chemists there had no organisation to promote meetings and discussion. The pioneers who ventured to form a "Committee of One Hundred," to provide New York chemists with the means of meeting regularly and exchanging ideas, included such figures as Dr. Leo H. Backeland and Prof. Marston T. Bogert, of whom the latter is still a distinguished member of the society. Mustering the 100 committeemen proved easy enough and on November 29, 1898, the Chemists' Club of New York was a going concern, with 154 charter members. It never looked back.

U.S. Forecast of Heightened Competition This Year *

PRODUCTION of chemicals in 1949 should equal the total for 1948, but competition will be keener in many lines. Industrial production may be slightly off in 1949 and, although it is true that the outlook for the chemical industry depends to a great extent on the level of general business activity, an offsetting factor is the growth trend of the chemical business as new products are developed and new markets are exploited.

During any phase of a business cycle, various industries reach a peak and go off. I believe we will see declines in many of the segments of the economy, but I do not think the general economic picture will deteriorate rapidly.

Since the war, the chemical industry has expanded more than any other industry, with the exception of food products. During 1947, the chemical industry spent $1.5 billions on new plants and equipment and will have spent $1.2 billions in 1948. This expansion should, for the most part, take care of the domestic demands for the near future.

Although we cannot tell as yet what the impact will be, we do anticipate more competitive conditions. Many leading chemical companies have borrowed hundreds of millions of dollars to construct new plants at high cost. With heavy fixed charges, there will be extreme pressure to keep these plants running at or near capacity.

This is, indeed, a challenging period for business leadership. When profits begin to shrink, there is extreme pressure to reduce expenses. Carried too far, the search for near-term profits may endanger the long-term profitability of a company. I really believe that we shall have several good years of business after going through a period of adjustment. If we should curtail promising research and development programmes now, we may be haunted later by lost opportunities and find ourselves rushing to completion the badly needed new facilities at the end of the business cycle.

One of the most important tasks during 1949 will involve cost reductions in all phases of operation. Any kind of cost reduction in the chemical business should be a research job, not a trimming operation.

* By Mr William M. Rand, president of the (U.S.) Monsanto Chemical Company in a New Year message.

New Year Honours

Awards in Industry

THE sciences and chemical industry were not singled out for distinctions in the current New Year Honours list. However, Sir John Boyd Orr, recently Director-General of the UN Food and Agriculture Organisation, was created a Baron; William G. Ogg, director of Rothamsted Experimental Station, and Henry Guy, chairman of the mechanical engineering research organisation of DSIR, became knights, the order of the GCB was conferred on Sir Henry Tizard, chairman of the defence research policy committee of the Ministry of Defence, and the CBE on Colonel W. C. Devereux, managing director of Almin, Ltd., and chairman of International Alloys, Ltd.

The British Empire Medal (Civil Division) was awarded to: John James Rees, process worker, Plastics Division, Imperial Chemical Industries, Ltd. (West Croydon, Surrey); William Roger Ross, senior foreman, Cellulose Acetate Section, British Celanese, Ltd. (Alvaston, Derby); and Alexander Wilson for services to the Ardeer (Imperial Chemical Industries, Explosives) Savings Committee (Saltcoats, Ayrshire).

YEAR'S COAL PRODUCTION

PROVISIONAL figures issued by the Ministry of Fuel and Power reveal that Britain missed three out of five of the coal targets in 1948, only open-cast production and exports reaching their objective. Deep-mined tonnage, total tonnage and manpower figures were all below the targets.

Total production was 98.78 per cent of the target of 211 million tons, the aggregate output for the year being 208,418,500 tons compared with the 1947 figure of 196,745,500 tons. In the last week of the year, which included Boxing Day and New Year's Eve holidays, total production was 2,588,100 tons (2,498,400 deep-mined, 89,700 opencast). An estimated tonnage of 1,145,600 was lost through holidays. In the corresponding week of the previous year, total production was 3,144,100 tons (3,050,600 deep-mined, 93,500 opencast), and 527,200 tons were lost through holidays.

Scottish Exhibition Plans

The chemical and allied industries in Scotland are expected to take a leading part in the Scottish Industries Exhibition, to be held in the Kelvin Hall, Glasgow, from September 1-17. Over 300 applications have been lodged for space. Display frontages will cover 2½ miles. There will be no rigid trade sections, but related firms and industries will be kept closely together.

Achievement and Prospects

Scottish Industrial Hopes in 1949

TRADE and industry in Scotland finished the year with a creditable record of achievement and reasonably good expectations for 1949, although fully aware of the stiff task ahead.

In some specialised departments of industry and technology, notably those associated with marine products, Scottish progress in 12 months has been greater than in any previous period. The full fruits of this have yet to be reaped.

At home, assuming some expansion of production in the new year and the continuation of a high level of employment, demand should remain strong. With increasing indications that competition will be greater in world markets, the export outlook is not quite so certain.

Plans for the exploitation of natural resources and the application of skill and industry to the conversion of imported raw material were intensified in 1948. Many of these, however, were of a long-term nature and can hardly be expected to be of benefit to industry this year.

Prospects would be greatly improved if a definite decision could be arrived at in 1949 on the development of new industries in the Highlands, particularly in electro-chemical and electro-metallurgical lines.

The main problem, meanwhile, is to maintain effective production and some expansion until the various proposed developments come into full production.

SCOTTISH INSTRUMENTS

PRODUCTION of scientific instruments will begin early in the New Year at the Watling Street, Motherwell, factory which was taken over by Metropolitan-Vickers, Ltd., and Newton Victor, Ltd., approximately a year ago. Newton Victor will manufacture X-ray equipment on a scale said to be larger than has been attempted elsewhere. Metropolitan-Vickers are to manufacture a new and advanced design of watt-hour meters for domestic service and switchboard instruments for power station and general industrial use. The two companies already employ 300 and may eventually employ 1500, including a large percentage of women.

Soap Export Licences.—The Export Licensing Branch of the Board of Trade announces that from January 1, consideration will be given to applications for licences to export soap to any destination. Applications for export licences (Form F), should be submitted direct to the branch at Regis House, King William Street, London, E.C.4.

The Royal Institute of Chemistry

Committee's Report for 1948

THE completion of one of the most ambitious programmes in its history is recorded in the annual survey of 1948 of the Royal Institute of Chemistry.

In order that it might be circulated in time, the report records only the 10 meetings of the committee held between the annual general meeting 1947 and the end of October, 1948.

A number of sub-committees were appointed, including those to consider development, education, films, students' welfare, and the new summer school sub-committee to explore possibilities of holding a course in analytical chemistry in the summer of 1950.

The honorary secretary attended the conferences of Honorary Secretaries held in London and Birmingham on April 17, 1948. The increasing importance of these conferences is shown by the space devoted to them in the journal of the institute. Mr. D. M. Freeland continued to act as Honorary Almoner and has now been appointed by the council to the Benevolent Fund Committee.

The numbers of Fellows, Associates, and Registered Students in the section at the end of the section's years have been approximately as follows:—

	1946	1947	1948
Fellows	1403	1435	1462
Associates	2190	2314	2349
Registered Students ...	508	525	537
Total ...	4101	4274	4348

During the current year the Mid-Southern Counties section has been formed and has taken 48 Fellows, 64 Associates, and 20 registered students from the section, but this has not appreciably affected the continued increase in numbers.

In Central London emphasis has been placed on professional aspects with the object of avoiding an overlap with the activities of other chemical organisations. Thirty-nine meetings were arranged.

As a continuation of a policy developed last year the possibility of local organisation was discussed at several centres and arising out of the meeting and discussion at Southampton, the Mid-Southern Counties Section of the institute has already been established, and a more comprehensive committee has been formed for the whole of Kent with representatives elected from Dartford, Gillingham, Gravesend and Wye.

The custom was maintained in the summer months of arranging visits to works and institutions, and so great was the response that places had to be allocated by ballot. During the year, 11 visits were arranged for members and three for registered students.

Meetings were also held at the Oxford and Cambridge Universities.

A number of meetings were held with the London branch of the Institute of Physics and other societies. A joint committee has now been arranged with the London section of the Society of Chemical Industry, two meetings having been organised for next year and an exchange of programmes arranged.

The committee records with satisfaction that the council has not only welcomed suggestions from the committee, but has invited the committee to carry out a special investigation into the educational requirements of the county of Hertfordshire and to examine the position generally throughout the section area. F. B. Marmoy attended as an observer a conference at Oxford on the expansion of higher education in Southern England on behalf of the institute.

Suggestions Accepted

The council also provided every opportunity for local section committees to make comments on the proposed new constitution of the institute and most of the suggestions emanating from the committee were accepted by the council.

The council authorised the committee "to provide through the Films Sub-Committee such support in the appraisal of scientific films as its members felt able to give." As a result, Mr. F. L. Allen was appointed to sit on the Appraisals Committee of the Scientific Film Association. Mr. D. M. Freeland has prepared a careful appraisal of all films exhibited to the section.

The committee has submitted a suggested pamphlet for students of chemistry, and special reports on education, scientific films and other matters to the council. The report adds that the committee regrets the apparent disagreement between the council and the committee at the annual general meeting at Birmingham, as recorded in the Journal, but believes that discussion of the points raised was desirable.

Many national organisations are centred in the London area with the result that many Londoners are unable to take as much interest as they might wish in all the organisations to which they belong. Nevertheless, the committee believes that, in spite of these counter-attractions, chemists should concern themselves more with what is, after all, their main professional organisation.

Benelux Chemicals

Production Reviewed for OEEC

THE account submitted by the countries of Benelux to the Organisation for European Economic Co-operation in Paris for transmission to the ECA authorities dealt at length with the future of the chemical developments. It stressed the absence of sufficient quantities of basic raw materials in the metropolitan areas which would serve as starting materials for chemicals, except salt and coal.

Because any other mineral or organic materials have necessarily to be imported, Benelux chemistry has essentially the character of a processing industry. Extension of the salt production is being planned, as well as increased exports.

The rapid rise of the output of aniline dyes, plastic powders and paint was emphasised. New developments have been fairly abundant among the phenol, films, paints, pharmaceuticals and phytopharmaceutic products.

The report also recorded the erection of modern oil refineries in the Netherlands which will increase the output of derivatives and synthetic detergents. While not more than 260,000 tons of synthetic nitrogen annually are expected at first, by enlarging existing factories the quantity obtainable in 1952-53 is expected to rise to 420,000 tons. Two-thirds of this nitrogen production is due to be exported. This is one of many projected schemes for enlargement and would seem to foreshadow the possible redundancy of natural nitrogenous fertilisers in the future.

Reference was also made to existing increase of soluble phosphorous fertilisers, especially superphosphates and bi-calcium phosphates.

Measurement of Acceleration

The accurate measurement and recording of acceleration by electronic methods is made possible by the DDR1000 Accelerometer Tube recently announced by Mullard Electronic Products, Ltd. This is basically similar in construction to an all-glass valve of the local type, and has the advantage that it may be mounted in any attitude. This, coupled with the high output and excellent response at low and zero frequencies, makes it particularly useful as a low mass pick-up for measuring and recording the acceleration and vibration of high velocity elements. It makes possible the observation and recording of acceleration without using a special high gain amplifier. It may also be used successfully for displacement velocity measurement and recording.

Industrial Restrictions

Conditions for Cement Expansion

THE Ministry of Town and Country Planning, giving permission to the British Portland Cement Manufacturers to extend their works in the Hope Valley, Derbyshire, following a public inquiry, has stipulated that permission was conditional upon the manufacturers conforming to eight regulations.

There must be an orderly programme of extension, to proceed by areas in a sequence approved by the Minister; dust emission must be controlled to the Minister's satisfaction; no additional rotary kilns may be installed without the Minister's approval: new buildings must be erected according to detailed plans, approved by the Minister, and the height of the chimney must not exceed 400 ft. As soon as practicable, the two existing chimneys must be brought down to the height of the buildings; to preserve the skyline, a wall of limestone is to be erected to form a barrier between the works and the Pindale Quarry, Hope. Schemes must be submitted for the planting of trees to screen the works, for the treatment of clay areas, including those already excavated, and for the disposal of waste; all plant, buildings and machinery shall be removed "at such time as the Minister is satisfied that they are no longer required for the purpose of the undertaking."

The firm claims that even the reduced scheme now permitted will enable it to add 175,000 tons to the 1947 output of 400,000 tons.

MODERN ALCHEMY

BECAUSE the efforts of the alchemists to turn base metals into gold had failed a belief had been implanted that persisted even during his early days that chemists were wasting their time, said Mr. J. Cameron Smail, presiding at a lecture on coal given by Prof. H. B. Nisbet in Edinburgh last week. He added that the chemists had now vindicated themselves. If they were not yet converting other materials into gold they were doing things equally wonderful.

Prof. Nisbet, after listing a few of the 2000-odd materials which could be made from the by-products of coal, described how compound and often highly complicated molecules were built up by the chemist into saccharine, DDT, benzene, sulpha drugs, and nylon, among other things.

Though the investigation of coal had produced some important results there was still a very great deal to be done, and some far more important use for coal might be found in the future.

Importance of Scottish Limestone

Further Investigation Desirable

From a Correspondent

THE Scottish Council (Development and Industry) is to be congratulated on having continuously emphasised the importance of utilising fully Scottish natural resources. Its latest report on "Some Scottish Limestones" (THE CHEMICAL AGE, December 18, 1948) reveals the economic possibilities of the relatively pure limestones in the Fortwilliam, Keith and Gorebridge areas, in all of which there are large reserves of easily worked material.

Question of Types

No estimate is given of the present Scottish production and consumption of building limes, and Mr. Matthew C. Kirkwood, director of Allan Kirkwood, Ltd., manufacturers of mortar lime for many famous structures during the last century or so, has pointed out that the report fails to bring out the different types of lime that are used in building, particularly those used in mortars and those used in plasters.

It is believed that in the former certain "impurities" contribute to the resistance of mortars to the effects of frost and sea water.

The subject has, however, been well opened by this well-printed report, and it is to be hoped that the new branch of the Building Research Station at East Kilbride will address itself to the study of all types of Scottish building limes, and will make clearer to the trade the chemical and physical behaviour of these limes in actual use and the effect of various impurities and processing treatments on their properties.

The report would probably have been of more value to technicians in the industry if it had been provided with a bibliography of papers on the preparation of lime and on the tests and specifications which apply. Moreover, some of the wording, presumably intended for a non-technical public, is rather unhappily expressed, such as "In the event of the limestone proving suitable for hydration" or "Lime produced from Scottish limestones appear to differ from those produced at Buxton in that they suffer from a slow slaking quality which must be got rid of in the process of hydration." The local term "limeshell" might mystify some readers, for it is used without explanation and is not given in Chamber's dictionary.

In the section on the plant required for evenly burning the limestone, too little emphasis is made of the need for even grading of size of limestone lumps or of temperature control in the process. Mixed-feed kilns are recommended, that is those in which the limestone and the fuel are put into the kiln together. This involves the separation of the ash from the limestone and causes some reaction between lime and ash.

There are probably local hot-spots in the mixed-feed type of continuous kiln. The possibility of using an externally-fired continuous kiln should therefore be more fully explored. A very efficient plant of this sort has been erected by the Gas Light & Coke Co., Ltd., at their Beckton works in London, to the design of their managing engineer, a Scot.

The writers of the report do well to condemn the policy of concentrating on agricultural limestone only, a legacy from the wartime operations of the Agricultural Lime Department (U.K.), but they could have strengthened their argument considerably if they had recommended working limestone for all possible applications, apart from the building uses with which they were primarily concerned, being the Building Materials Committee of the S.C. (D. & I.).

Other Methods of Use

However, one can here add that further investigation into the uses of Scottish limestones, and burnt and hydrated limes, is desirable in the paper, leather, chemical, water, and road-building industries. The suitability of Creag Aoil limestone for the manufacture of calcium carbide and calcium cyanide is also of great importance to future Scottish economy. It would be interesting to know the consumption of each type of product in each of these and other industries.

The Scottish Council (Development and Industry) will be issuing a series of these reports, so it is to be hoped that further progress on limestone investigations will be reported by them in due course. The next report, it is believed, will be on Scottish tales.

Italian Chemical Producers Alarmed.—The recent reports that imports of copper sulphate are being negotiated by the Italian Government, have caused alarm among the factories making this product in Italy. It is pointed out that, buying at Government auction sales, Italian factories pay much more for copper than their foreign competitors. It is feared, that if really substantial quantities of copper sulphate come into Italy from abroad, many local factories will have to close down.

New Factors in Chemical Industry

Equipment and Maintenance Still Difficult

By PETER C. BISHOP, B.Sc., A.R.I.C.

THE past year must have been disappointing to many engaged in chemical industry. Harassed works managers have seen their hopes of early reconstruction of war-worn plant recede further as restrictions on capital investment have continued. Those fortunate enough to be permitted to instal new plant have found that the erection often falls months behind schedule owing to difficulties of material supply.

Maintenance of existing plant has in itself been a major problem owing to shortages of all kinds, even of small fittings such as nuts, bolts and pipefittings. Date of delivery has often been eight to nine months from receipt of the order and in exceptional cases the period is likely to have extended to 18 months.

Continuing Scarcities

When existing stocks of certain kinds have run out, the only solution has been to salvage material from disused plant or from the scrap-heap. The storekeeper at one large works said that the supply position has had one advantage, in that it has enabled him to get a lot of second-hand material off his hands which in normal times would never have been used. The distribution of steel and timber is still subject to controls, but some items that no longer require authorisation have become even more difficult to obtain than before.

The year has ended on a more hopeful note, however, with the recent announcement of an increased rate of steel production. Moreover, the Government's policy with regard to export of chemical plant should in the long run be helpful to the chemical industry of this country.

Confirming the view that increased production of chemicals helps either to swell exports or reduce imports (depending on the particular chemical), it has been impressed on plant manufacturers that the requirements of the home market must receive adequate consideration. In consequence, no target has been set for the export of chemical plant. This, however, has certainly not yet produced any visible diminution in the export returns of chemical and similar machinery.

In a review of a comprehensive field such as the chemical industry offers, space prevents mention of more than a few developments. It cannot even be pretended that the more important items are mentioned. Importance is relative, depending upon the point of view.

An innovation of general interest during the year, however, was the first Mechanical Handling Exhibition at Olympia in July. A basic part of the chemical engineer's training deals in detail with the movement of fluids, but the movement of solids is a subject often receiving sparse treatment, possibly because it has no elegant mathematical theory behind it.

In addition to the exhibition, a convention on mechanical handling was held. Several of the papers presented should be of interest to those in chemical industry particularly. "Coal, Coke and Ash Handling at Power Stations," by Mitchell, and Fox's paper on mechnical handling methods at gasworks and coke-ovens. As their titles suggest, these two papers deal with the movement of large quantities of materials in bulk. At the exhibition a wide variety of cranes, trucks, mechanical shovels, conveyors and hoists was to be seen, but the following remarks are not entirely confined to the exhibits.

For handling powders and small lumps the totally-enclosed Redler conveyor has many applications in the chemical works, and it has proved its value over a long period. It consists of an endless chain of flights, which can vary in shape to suit the material, moving in a closed duct. The duct can be straight or curved, and vertical, inclined or horizontal. Contamination problems and dust nuisances are minimised.

Lighter Structure

A recent development in the popular Chaseside mechanical shovel is a type with adjustable jib for use in confined spaces. In the Chaseside shovel the bucket can be raised and lowered vertically but cannot be slewed. This leads to a far simpler and lighter structure built on a tractor chassis, although, of course, more movements are necessary in operation. The scoop is lowered in front of the machine which is driven forward into the material to be picked up. The bucket is raised and the vehicle is then backed and driven to the unloading point where the bucket is tripped.

For the handling of material in bulk in the open air the bulldozer has proved to be a useful machine, especially the small model or "calfdozer." A particular case in which it is used with advantage is the unloading of ore from ships to a wharf. The material

New loading machinery produced during the year has substantially eased chemical handling problems as well as those of the colliery industry for which much of it was designed. This Barber-Greene loader, which automatically rejects fines, is within this category.

has to be transferred from the hold of a ship by means of a crane and grab on to a stock heap which extends some distance back from the waterside, beyond the reach of the jib and above the lift of the crane.

In the past it was necessary to employ lorries or rail wagons to receive the material from the grab and to run up the heap to tip, and delays were inevitable.

Material is now grabbed out of the ship and dropped straight on the ground. The bulldozer then pushes it up the heap, and, having a caterpillar track, can ascend a heap at a far steeper angle than a lorry, hence facilitating compactness of the stock heap. If it is necessary to reload the material it can push it back within reach of the grab.

It is, in fact, performing the function of a drag scraper, but has greater adaptability It can be used during slack periods as a form of mechanical broom for sweeping up material dropped by trucks or mechanical shovels over a wide area. It can also be used for spreading and turning partly spent gas purifying material during its period of aeration. The track is useful here for breaking up large lumps.

For bulk loading of lumpy materials combined with removal of fines, the Barber-Greene mobile coal loader is of potential interest in a wide field. It consists of a form of inclined endless chain conveyor, which picks the material from the foot of the stock heap and elevates it above the side of the vehicle to be loaded. The chain then takes a turn to a slightly falling angle, and the material passes over a fixed bar screen before discharge into the vehicle. Fines passing through the screen are discharged by means of a side chute. The angle of elevation can be varied, and the machine is supported on power-driven wheels.

Handling problems of a completely contrasting character were dealt with by Edgington in a paper presented recently to the Institution of Chemical Engineers on handling sterile medical products. After discussing methods of sterilisation, the author described plant for the purification of air chemically and by ultra violet light before supply to rooms used for aseptic manipulation. The technique used in these rooms was then dealt with.

Manipulation Temperatures

Considering now some trends in plant technology, in the attainment of low temperatures, the regenerative principle is increasing in importance since its introduction some years ago.

The regenerator or intermittent heat exchanger has been a feature of the high temperature furnace for a very long time. In this case, the hot waste gas from the combustion chamber has been passed over a large mass of checker brickwork, which has been raised in temperature. After a fixed period, the flow is reversed and the air or fuel gas or both on the way to the furnace are passed over the hot checkers and attain a high degree of preheat.

By the use of a pair of regenerators to each furnace, one on the feed air or gas and one on the waste gas, with reversals at, say, half-hourly intervals, considerable fuel economy is obtained. In furnace work, the regenerator was developed because the only materials available for withstanding the high

temperatures involved (usually refractory brickwork) were not suitable for the construction of a continuous heat exchanger.

In refrigeration practice, on the other hand, the great advantage of the same principle is that the conventional tube-and-shell heat exchanger becomes easily blocked by ice or solid carbon dioxide deposited from the cooling air or gas. With the regenerator, insufficient solid is deposited between reversals to stop the gas flow. On reversal, the deposited solid is removed by evaporation.

Hence the regenerator plays a two-fold role; it acts as a means of heat transfer, and also as a means of removing certain unwanted constituents from the gas entering the system. A major disadvantage which applies equally to regenerators on heating or cooling systems is that complete separation of the two gases is not possible in practice, because on reversal inlet gas is passed into a vessel full of outlet gas and *vice versa*.

Oxygen

The use of this principle in the "Rescol" process for the production of medium purity oxygen (85 per cent to 98 per cent O_2) was described by Schuftan in a paper presented to the joint conference of the Institution of Chemical Engineers and the Low Temperature Group of the Physical Society last February.[1]

He claims that the process gives a thermodynamic efficiency of 19 per cent, compared with 13 per cent obtained with the usual process of oxygen production. This leads to a substantially lower power consumption with a corresponding reduction in cost. The uses of medium purity oxygen are discussed in a book issued recently by the British Oxygen Company entitled: "Oxygen: Its Potentialities in Iron and Steel Production."[2]

The same author told of the use of regenerators for the recovery of ethylene from coke oven gas at a meeting of the Chemical Engineering Group in November 1947.[3] In this plant erected by the British Oxygen Company at Corby, coke oven gas from an adjacent steelworks is cooled in regenerators, and water vapour, carbon dioxide, hydrogen sulphide and some benzol are condensed therein.

After the ethylene has been removed by further cooling, the residual cold gas passes back through the regenerators, and is subsequently returned to the coke oven plant. The plant is said to be capable of producing 2000 tons per year of ethylene of 97 per cent purity.

A further example of the recovery of chemicals from coke oven gas by the application of cold (but here without the use of regenerators) is seen at the Flixborough plant of Nitrogen Fertilisers, Ltd.[4]

In this process, nitrogen and hydrogen are separated by cooling the gas in stages under pressure, leading to condensation of nearly all other constituents, the final purification being carried out by washing the gas with liquid nitrogen at −180° C.

The residual gas is mixed with further nitrogen obtained from air and passed to a catalytic ammonia synthesis unit. The ammonia is passed to saturators to form ammonium sulphate. The sulphuric acid is prepared by the contact process in an adjacent plant which has a number of interesting features described by Millett in a recent paper.[5]

Coke Oven Expansions

Coke ovens are becoming of greater interest to the gas industry for the manufacture of gas as the primary product. Steelworks and colliery coke oven plants have, of course, sold their surplus gas to supply companies for a considerable period. In Sheffield, for example, about 80 per cent of the gas sold is bought from outside sources and purified for redistribution.

In 1932, the Gas Light and Coke Company put to work the first battery of coke ovens at Beckton. They are now expanding their coke oven plant, and the third battery was formally put into operation by the Duchess of Kent in November 1948. Like the other units, this is of Koppers design, and it was erected by the Woodall Duckham Company. A fourth battery is under construction.

The South Metropolitan Gas Company have two batteries of Simon-Carves ovens under construction at East Greenwich, as a major part of an extensive rebuilding programme, and are making provision for further extensions on similar lines.[6] The producer gas for firing the ovens will be generated in Marischka producers erected by Humphreys and Glasgow, Ltd. These producers will raise steam in annular jackets at 150 p.s.i. for power and process purposes.

Economical Carbonisation

From the gas engineer's point of view, coke ovens have the advantages of giving a high calorific value gas with a lower fuel consumption and reduced labour requirements, compared with other types of carbonising plant. However, they are relatively lacking in the flexibility essential to a process whose output is controlled by weather conditions, and in consequence, their field seems likely to be confined to the larger works where they can take the base load.

Flexibility of output can be obtained by the use of compound ovens capable of being fired alternatively by producer gas or by coal gas. A reduction of demand is then met by firing some or all of the ovens with coal gas. This, however, leads to a higher coal consumption per unit of gas sold and increased coke production.

That abounding source of organic chemicals, coal tar, again received well merited attention in several quarters during the year. An interesting addition to the literature was a recent paper by Curtis[7], in which the operation of a modern distillation plant was described in some detail, and the separation of various fractions was discussed. In particular, the recovery of naphthalene sufficiently pure to be converted to phthalic anhydride received much attention.

Pointing out that not more than half the naphthalene available in coal tar is recovered as such, the author stressed the necessity for close fractionation of the naphthalene oil. In the plant under consideration, the oil contained over 70 per cent naphthalene, representing 80 per cent of the total naphthalene in the original tar.

Styrene for Paint

In the technology of paint manufacture, an important development has been the copolymerisation of styrene with drying oils in the formulation of durable paints. This has been the subject of several years' research, resulting in a number of patents.[8] The research was followed by the recent announcement by Lewis Berger and Sons, Ltd., of a new plant now engaged in the production of styrene copolymers for use in "Bergermaster" paints.

Probably the most important innovation in the field of dyestuffs was the production by the Dyestuffs Division of I.C.I., Ltd., of Alcian Blue 8 G.S. The first of a new type, it has a remarkable fastness. It can be printed on various textiles and on paper, and the shade is almost unaffected by the nature of the material. The colour is regarded as being an exceptionally bright turquoise.

In the manufacture of sulphuric acid, in addition to the paper by Millett already referred to, a lecture by Cormack in October described the production of 96 per cent sulphuric acid. Here a modification of the chamber process is used, and a concentrating tower is operated in parallel with the Glover tower.

Turning now from practical realisations of the immediate past, one interesting possibility for future development calls for notice.

Elementary fluorine has attracted much attention in the past few years. Before the war, fluorine was almost entirely confined to the laboratory, and was regarded by most people with trepidation. A number of useful compounds of fluorine requiring the free element in their preparation were, in consequence, not commercially available.

Interest in fluorine developed during the war principally as a result of the work on atomic energy. One method of separating the isotopes of uranium is to take advantage of the difference in the rates of diffusion between the volatile hexafluorides of the two isotopes. Since uranium hexafluoride requires the use of elementary fluorine in its preparation, it was necessary to develop methods of manufacturing the element on a large scale.

In principle, the method of preparing fluorine is the same as that devised by Moissan over 60 years ago, namely, the electrolysis of an anhydrous solution of potassium fluoride in hydrogen fluoride. This process is now in full scale operation in the U.S.A., being worked, for example, by the Pennsylvania Salt Manufacturing Company.[9]

There, steel cells with a carbon anode and a steel cathode are each producing 60-80 lb. of fluorine per day, operating at 1500-2000 ampères. The electrolyte contains 40 per cent hydrogen fluoride and 60 per cent potassium fluoride, the mixture having a melting point of 72° C., and the operating temperature being about 35° C. above the melting point. The crude fluorine is purified by passing through sodium fluoride. In this country, I.C.I. is proceeding on similar lines, although at present operating only on the pilot plant scale.

Fluorine can be contained in vessels of copper, mild steel and brass, as a protective layer of fluoride is formed which reduces further attack. Where the layer is likely to be disturbed, due to vibration, or in valves, nickel and Monel metal are recommended.

Of these compounds, chlorine trifluoride is of contemporary importance. It contains 62 per cent of fluorine and can be stored as a liquid under a pressure of 25 lb. p.s.i. It is very reactive and can be used in place of fluorine in many cases. Di- and tri-fluorides of silver, cobalt and mercury are also suitable for fluorination purposes.

The development of the use of fluorine compounds opens up a wide field, as Rudge has pointed out in a recent lecture.[10]

Fluorine represents, of course, only one of the several "new" avenues in which during the past year wide prospects have been opened. Such enterprise is the best assurance that adequate foundations have been laid in 1948 upon which will be raised new enterprises essential to maintain chemical industry on a virile and prosperous basis.

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[2] *The Chemical Age*.
[3] *Ibid* 99 (14/2/48).
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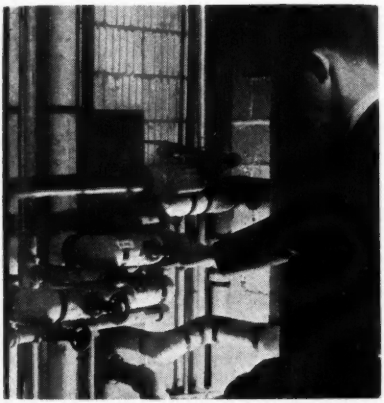
[7] Inst. Chem. E (N.W. Branch), (8/11/47)
[8] B.P. 573809, 573835, 580913.
[9] *Chem. Eng.* 1948 55, part 4 (April), p. 102.
[10] *Chemistry and Industry* (13/11/48).

NEW TRENDS IN LABORATORY DESIGN

Lavish Services in U.S.A.

(By a Special Correspondent)



Above: Outside each laboratory in the new chemistry and physics building of the American Socony-Vacuum Oil Research and Development Laboratories is an access door for individual control of the laboratory's utilities. Below: A general view showing the extent of the laboratories; to the left of the main entrance is the new chemistry and physics building

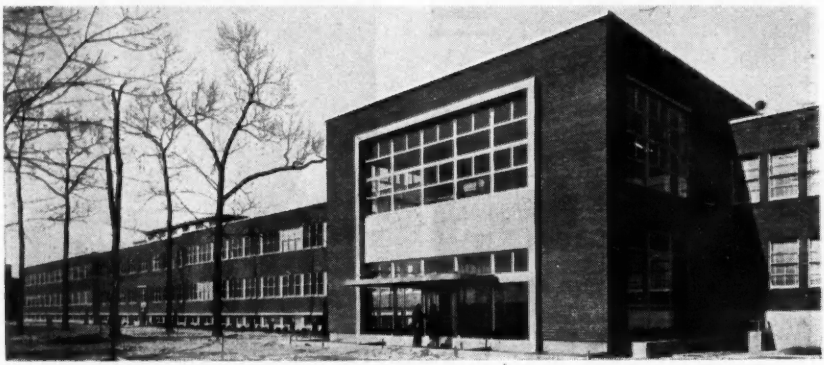
THE range of laboratories lately completed for the Socony-Vacuum Oil Company can claim a special interest here just now, as well as in the U.S.A., where it is credited with being the largest and most comprehensively equipped. In Great Britain, the big extension of oil refining, projected and in progress, sharpens the interest in the subject of laboratory design, arising out of the need for widened research facilities of many kinds and improving prospects of being able to provide them.

The Socony-Vacuum chemistry and physics building at Paulsboro, New Jersey, is designed for fundamental as well as practical research for improving all petroleum products and developing new ones and equipped to make full use of all the newer techniques. It is adapted, for example, to permit the study and use of radioactive elements as tracers in work on difficult lubrication problems, and to encourage control of chemical reactions by electronic methods.

The equipment includes a newly-developed electron microscope (×100,000), equipment to "photograph" the interiors of solid substances, an emission spectrograph and a mass spectrograph.

The building and its equipment will enable 120 chemists and 45 physicists to carry on their work, much of it in quarters where temperature, relative humidity and other factors are controlled automatically with great precision. In addition, it includes a library (staff 11), administrative offices, control rooms and a large, glass-panelled lobby which becomes the main entrance for the entire group of laboratory buildings.

Each of the many chemical laboratories on the basement, first and second floors is equipped with its own exhaust system for removal of gases and impure air. This calls for about 125 separate motors and blowers, located on the building's roof.



An unusual construction feature of the new building is the grouping in recesses in the hallway outside each laboratory of piping for quick, easy access to the water, compressed air, steam, gas and other service lines supplying the laboratories. Thus any laboratory can be isolated at will without interruption to the others.

The new chemistry and physics building consists of two interconnected units—one for the laboratory section, the other housing the main laboratory lobby on the first floor and a greatly-expanded library on the second. The library will include more than 7000 technical books and will have well-lighted study facilities for up to 50 scientists and engineers at one time. The library subscribes, incidentally, to more than 200 scientific and technical journals and magazines.

The building utilises filtered, conditioned air in many of the rooms and also includes three large conference rooms—one with a capacity of 100 persons and with facilities for motion pictures—and special rooms such as a physics machine shop, a glass-blowing shop for production of special laboratory equipment and store-rooms. One of two cold rooms, in addition, provides artificial temperatures to 20°F. below zero.

Another interesting example of close temperature control is the infra-red laboratory in the basement, with double glazing and vestibules at the entrances, which contains equipment to maintain a temperature which will not vary by more than 1° and a relative humidity of 25 per cent.

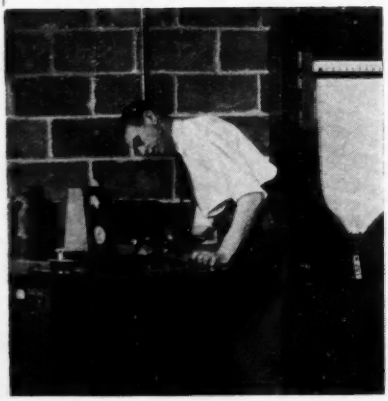
The general construction of the building is concrete frame with brick facing and continuous window bands. The laboratory section is about 52 ft. wide and 350 ft. long, and the unit containing the main lobby and library is 51 ft. wide and 65 ft. deep.

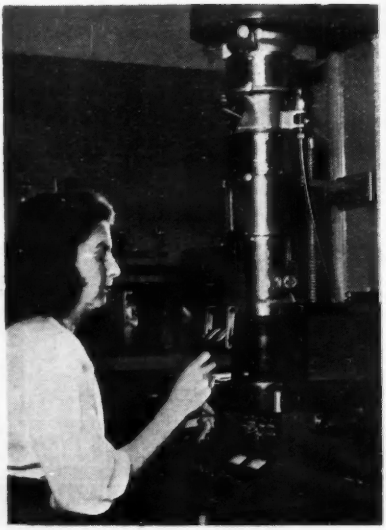
Hoods and bench tops in all of the laboratories are of stone for durability and easy cleansing. In addition, there are more than 100 all-stone sinks and special distillation racks through the chemical section.

Compressed air for the laboratories is supplied by two compressors with individual capacities of 116 cu. ft. per minute at a pressure of 20 lb. p.s.i. Vacuum pumps handle 175 cu. ft. per minute, while oxygen and nitrogen are fed into a central system for the laboratories from tanks in the basement. Steam is available in the laboratories at pressures from 15 to 400 lb. p.s.i., and gas consumption from a central laboratory system is estimated at 2000 cu. ft. per hour. In the physics laboratories electric service is supplied from a central panel, affording changeable voltages, a.c. or d.c., as required.

A central drainage system serves all the laboratories, leading to a sump from which the waste is pumped to a central disposal area. Controls throughout the building are operated by air motors, while separate thermostats and humidistats are installed in each zone.

Below: X-ray diffraction unit for highly detailed analyses of crystalline solids by indicating the ordered arrangement of the atoms within the material. Right: Electron microscope (×100,000)





Progress in Medicinal and Fine Chemicals

Substantial Advances in Analgesics

by G. COLMAN GREEN, B.Sc., F.R.I.C., A.M.I.Chem.E.

ADVANCES in this field are dependent to a large extent upon individual inspiration and are not, generally speaking, capable of being produced at will according to "five-year plans" or to the imperious demand of an "S. R. & O."

The nature of science is such that progress is sporadic, every new advance being followed by a period of consolidation of thought and of technique. These periods of consolidation, which may often have the spurious and superficial appearance of quiescence, serve to vernalise and fertilise the ground for another flowering in what often seems to be an unrelated study.

A supreme illustration of this situation is to be found in chemotherapy, where thought was suddenly crystallised by Domagk and lead to the vastly important developments in sulphonamide therapy during the subsequent decade, with the consequent mitigation of much human suffering. Activity in the sulphonamide field reached its peak in the earlier years of the last war, during which circumstances offered much scope for the accumulation of practical experience and knowledge of this group of drugs.

A New Field

The past five years have been relatively uneventful so far as the sulphonamides are concerned. After a period of vigorous medical and commercial exploitation, their use and manufacture have become incorporated in an unspectacular routine. Nevertheless, the development of sulphonamides as chemotherapeutic tools has opened up a wide new field of research in the mechanisms of bacterial metabolism and the name of McIlwain comes immediately to mind in this connection. Such studies will not at the moment appear spectacular to the layman, but it would be folly to deny their significance.

As another example, the magic touch of Fleming and Florey, crystallised decades of patient thought in the field of microbial antagonism, leading to the astonishing amount of concentrated specialist activity, both in Britain and the U.S.A., in the war-years. It will be recalled that public interest was aroused to a degree never experienced before; it has understandably become less as home-manufactured bulk supplies have become increasingly available.

The activities of research workers, however, remains unrelaxed and continued studies in the field are leading to the isolation of new antibiotics such as chloromycetin as well as increasing knowledge of streptomycin.

Metopon

Developments in the field of analgesics has followed an unspectacular path for many decades, until in the past 12 months researches in the U.S.A. and Germany culminated in the introduction into therapeutics of Metopon and Amidene. That achievement has to be associated with the emergence of pethidine a year or two earlier, since their introduction terminates an epoch—extending over some 140 years—during which morphia alone has held a dominating position among the more potent analgesics.

Morphine is as yet unsynthesised, although its structure is well established by the work principally of Robinson and his associates. Among the synthetic analgesics, the position of pyramidone has been unchallenged until the synthesis of pethidine.

Morphine was first isolated by Serturner in 1806, but it was not until the introduction of the hypodermic syringe by Woods that the pure drug came widely into use. These events and the elaboration by Gregory of the first economically feasible large-scale manufacturing method have been dealt with by the present author elsewhere (*Nature*, 1946, *157*, 465).

The dominant position of this drug is reflected in the *Lancet*, "Annotation" (August 23, 1947, p. 286) 141 years after its isolation. This is not changed by the existence of pethidine and a fairly comprehensive knowledge of its characteristics: "Few doctors would care to be deprived of a therapeutic tool of the power of morphine; indeed, it is hard to imagine what medical practice would be like without it. All the more pity, therefore, that this drug so easily captures those it relieves in the trap of addiction."

This annotation gives the clue to the direction of all efforts in the analgesic field:

a readily accessible drug, equally as powerful analgesically as morphine, but without its undesirable effects.

For many years past, extensive research has been carried out in the U.S.A. under the auspices of the U.S. Committee on Drug Addiction of the National Research Council. The objects of these researches were, broadly speaking, those stated above. The names of L. F. Small and H. B. Eddy and their co-workers will long be associated with pioneer work in the synthetic analgesic field. Apart from yielding contributions of inestimable value to chemistry in respect of complex structures associated with the morphine molecule, the work of this school has culminated in the production of the analgesic drug Metopon.

Initial Studies

It is true metopon, or methyl-dihydromorphinone, was synthesised and reported by Small *et al.* (*J. Amer. Chem. Soc.*, 1936, *58*, 1457) over 10 years ago. The synthesis was the result of purely theoretical studies in chemical synthesis and only during the past 12 months or so have the initial pharmacological and clinical studies been completed and the evaluation of this analgesic drug made known.

Metopon is not available in Britain, but limited distribution has been made in the U.S.A. to doctors *direct* (not through pharmacists) and to hospitals through the National Research Council, to be used for the treatment of pain in inoperable cancer.

The use of metopon is limited to this disease because it is there that it has its most important use and supplies are strictly limited and are likely to remain so.

In treating the intractable pain of cancer metopon seems to have a predominant rôle to play because, as compared with morphine, metopon has an enhanced analgesic effect and a decreased sedative, euphoric, emetic and intestinal effect.

Administration

Another very significant characteristic is that the drug is equally effective whether administered orally or parenterally, and furthermore, its characteristics permit it to be administered not at stipulated intervals but according to the onset of pain.

The drug is covered by Small in U.S. Patents 2,178,010, October 31, 1939, in the interests of public safety, but the patent is dedicated to public use. In the U.S.A. three firms already licensed to manufacture morphine from opium are licensed to manufacture metopon. The firms Sharp & Dohme and Parke, Davis are specially licensed distributors (*J. Amer. Pharm. Ass.* (Pr. Pharm. Edit.), 1947, 8 (9), 430). It has been pointed out (*J. Amer. Med. Ass.*, 1947, *134*, 291) that, while metopon resembles morphine qualitatively there are important quantitative differences. These may be summarised thus:—

(a) The analgesic effect of metopon is *at least* twice that of morphine.

(b) The analgesic effect has twice the duration of that of morphine.

(c) Metopon is nearly free from emetic action characteristic of morphine.

(d) Tolerance appears more slowly and disappears more rapidly than with morphine.

(e) Physical dependence builds up more slowly than with morphine.

(f) There is little or no respiratory depression in therapeutic doses.

(g) Less mental dullness is induced than with morphine.

(h) Metopon is relatively highly effective when administered *per os*.

High Costs

During the first phase of clinical trials metopon was administered where addiction has already been established with morphine, since it partially prevented impending physical and psychic dependence. Its use was soon restricted to the purpose described.

Metopon hydrochloride is prepared in 3 mgm. doses in capsules. Two to three capsules are administered orally.

It is extremely improbable that metopon will replace morphine; it is always likely to be very expensive because of the relative scarcity of the raw materials and the cost of the synthesis itself.

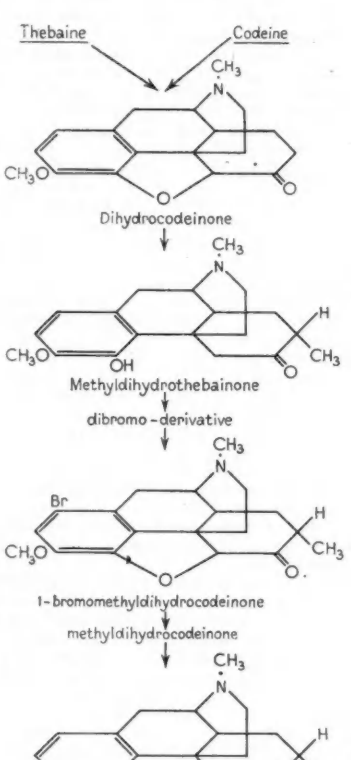
The starting materials for metopon synthesis are either thebaine or codeine. These are both naturally occurring opium alkaloids. The richest source of codeine is Indian opium, in which it occurs to the extent of 2.5 per cent, since demand for this drug always exceeds supply of the natural material, the natural source is supplemented by synthetic codeine obtained by methylating morphine, of which codeine is the methyl ether.

Thebaine occurs in opium in even smaller quantities than codeine. It averages about 0.5 per cent, is not synthesised and, indeed, is not normally recovered from opium. Codeine is currently available at around 50s. per oz.

Dihydrocodeinone is first obtained by the hydrogenation of thebaine to its dihydro derivative and its subsequent hydrolysis; or it may be obtained by catalytic rearrangement of the codeine molecule.

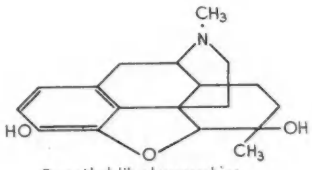
Dihydrocodeinone is reacted with methyl-magnesium-iodide which introduces a methyl group in the 7-position. The oxide ring, opened by reaction with the Gringard re-

agent, is closed again by dibromination and alkali treatment. One bromine molecule is removed at this stage while the remaining bromine in the aromatic nucleus is removed by hydrogenation. The debrominated ketone, methyldihydrocodeinone, is finally demethylated to methyldihydromorphinone or metopon. The series of reactions are :—



As indicated, metopon was synthesised, largely as the result of studies of reactions between the morphine ketones with organo-magnesium halides, to which they are extraordinarily resistant. This resistance has, however, been found not to be so great when lithium replaces magnesium in the Gringard reagent.

This finding has also lead to the synthesis of 6-methyl-dihydromorphine (Small and Rapoport, *J. Org. Chem.*, 1947, *12*, 284), which is reported to be notable for its prolonged analgesic action. However, no further information is available on this drug.



Tainter (*Ann. N.Y. Acad. Sc.*, 1948, *51*, 8), writing on the subject of "Pain," divides the progress made in analgesia into four eras. The first era extends from remote historic times to the end of the 18th century, when opium, henbane and mandragora, in one presentation or another, were the principal agents for the alleviation of pain. The active principles were unknown and the drugs variable in potency and clinical result.

The second era was opened by Sertürner's isolation of morphine and its recognition as the first pure alkaloid. Gregory (of "Gregory's Salt" fame) elaborated the first economically feasible process and there quickly followed the isolation of the other opium alkaloids—codeine, thebaine, haparerine—as well as alkaloids from other natural sources. The latter included quinine, cocaine, nicotine, atropine, caffeine, etc.

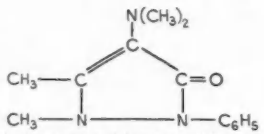
These pure alkaloids offered the advantage of precise dosage and known response and, of course, remain in use to-day.

Tainter's third era opens in 1828 with the synthesis of urea by Wöhler, which led to the synthesis of salicylic acid by Kolbe and Lautemann in 1860. Subsequently, Dreser introduced acetylsalicylic acid into medicine in 1899.

The use of aspirin, a mild analgesic with a large margin between toxic and therapeutic doses, rendering it suitable for self-medication, has reached literally colossal proportions to-day.

The other antipyretic/analgesic drugs of the so-called "coal tar" group were introduced (mainly as antipyretics, their analgesic properties not being recognised until later) a little earlier than aspirin—acetanilide in 1886, antipyrin in 1884, phenacetin in 1887 and pyramidon in 1896. Tainter points out that pyramidon (4-dimethyl-

amino - 1 - phenyl-2-3-dimethyl-5-pyrazolene) has remained the most powerful *synthetic* analgesic available up to very recent years.



Pyramidon (Amidopyrin)

The fourth era postulated by Tainter is characterised by the availability and combination of a high degree of development and refinement of organic chemical techniques and the elaboration of methods of testing the analgesic activity of drugs.

The era was introduced by Small and Eddy in the U.S.A. in their studies of the morphine molecule and their attempts to discover the pharmacodynamic nucleus of morphine and to modify the morphine structure so as to retain its powerful analgesic effect while eliminating the undesirable side effects. This has led to the synthesis of metopon.

An entirely new approach to the problem of analgesia was initiated within this era by a systematic search for antispasmodic agents with anticholinergic properties, after the atropine model. This led to the discovery by Eisleb and Schaumann of I. G. Farbenindustrie (*Deut. med. Wochenscher.*, 1939, *65*, 967) that phenylpiperidine esters had important analgesic as well as antispasmodic properties. (*See* also *Eisleb. Ber.*, 1941, *74*, 1433).

The synthesis and introduction of the most important drug in this group so far—pethidine (dolantin; demerol; meperidine; isonipecaine; ethyl ester of 1-methyl-4-phenyl-piperidine-4-carboxylic acid)—has been referred to in earlier reviews in this journal and it will not be dealt with at any length on this occasion except to the extent that, with fast increasing knowledge and wider vistas, it appears to be part of a broad pattern which is becoming established.

Pethidine has found its own place in analgesia especially where its additional antispasmodic effects are of some advantage as, for example, in obstetrics. Its spasmolytic action is also useful in the treatment of pain due to angina pectoris, asthma, arthritis, etc.

It is analgesically about one-tenth as effective as morphine and has failed to fulfil earlier hopes that it would not promote addiction. It is, of course, scheduled as a dangerous drug.

Pethidine hydrochloride receives a monograph in the 1948 edition of the British Pharmacopœia.

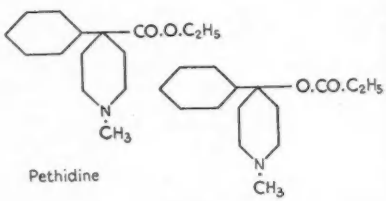
Extensive inquiries were made on advances in synthetic analgesics in general and in those on the pethidine pattern in particular at the end of World War II. The findings in respect of pethidine have been reported principally in *B.*, 22624, *766*, 60, and in *B.*, 24, *116*, Appendix 15.

A certain amount of work in the pethidine series was also reported, and this has stimulated a search for derivatives with even more acceptable properties, especially in the U.S.A. These studies were based on "Höchst 10446" which is parent of a series in which the carbethoxy group in pethidine is replaced by —CO—alkyl and the simultaneous substitution in the meta- position of the phenyl nucleus of a hydroxy group.

These changes led to increased analgesic and spasmolytic effects. "Win 1539" or ketobemidone (bemidone being pethidine with the hydroxy group in the meta position), which appear to be synonymous for Höchst 10446, is at present undergoing clinical appraisal in the U.S.A. (Youkman, *Ann. N.Y. Acad. Sc.*, 1948, *51*, 78).

Foster and Carman (*J. Pharm. and Exp. Therap.*, 1947, *91*, 195) have studied a series of piperidine derivatives prepared by Lee *et al.* (Jubilee vol. *Emil Barrell*, Basle, 1946, 264) and conclude that for analgesic activity the 4-phenyl radical is essential and it may not be replaced by benzyl, naphthyl, *p*-lotyl or *p*-methoxy phenyl. They also find that the 4-acyloxy radical is essential and deviation from the group reduces analgesic activity.

Substitution of both acyloxy and phenyl in the 4-position is essential. Further, they state that the replacement of the carbon-carbon link in the 4-acyloxy group in pethidine by the carbon-oxygen link in NU-718—



Pethidine

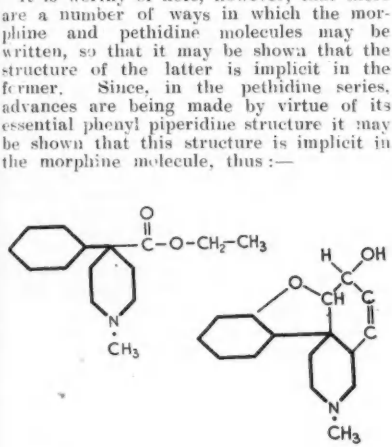
—leads to a marked enhancement of analgesic activity. NU-718 is at present undergoing clinical trial.

These compounds are derived from N-methyl-4-phenyl-4-hydroxypiperidine by the

action of Gringard reagents or organolithium compounds on 4-piperidine, followed by acylation of the organometallic complex.

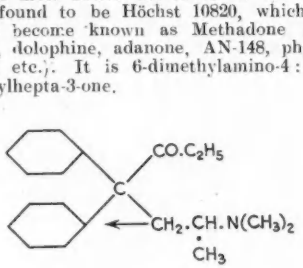
It is an interesting fact that pethidine was discovered as a consequence of researches not directed to the discovery of analgesics.

It is worthy of note, however, that there are a number of ways in which the morphine and pethidine molecules may be written, so that it may be shown that the structure of the latter is implicit in the former. Since, in the pethidine series, advances are being made by virtue of its essential phenyl piperidine structure it may be shown that this structure is implicit in the morphine molecule, thus:—



Another class of synthetic analgesic was also developed in Germany during the war. The studies leading to this development followed those which lead to the development of pethidine; but this class of compound is more than ever remote from the structure of morphine and it is difficult to find any resemblance.

The most active substance in this class was found to be Höchst 10820, which has since become known as Methadone (amidone, dolophine, adanone, AN-148, physeptone, etc.). It is 6-dimethylamino-4 : 4-diphenylhepta-3-one.



The German synthesis (*B.* 22 and 24, *1404*, 141; *B.* 22 and 24, *766*, 305; *B.* 24, *116*, 51, 52 and 65) consisted in the condensation of diphenylacetonitrile and 2-chlorodimethylamino-propane to yield an interesting mixture of isomeric nitrile bases which, on treatment with Gringard reagents, yields methadone and a ketimine which can be hydrolysed with difficulty to isomethadone.

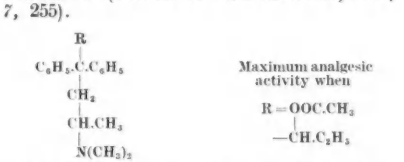
The past 15 months has shown great activity in elucidating the mechanism of the reaction and of establishing the clinical value of the drug. It is doubtful whether the Germans succeeded in resolving the drug of which the l-isomer alone is of any interest.

Thorpe *et al.* (*Nature*, 1947, *160*, 605) resolved with d-tartaric acid at the nitrile stage.

It is a puzzle why the Germans did not vigorously exploit Höchst 10820, especially in view of the shortage of morphine; but, already, a large literature is springing up in the U.S.A. and Great Britain on physeptone and its variants.

Work on these variants has been described by Chen (*Ann. N.Y. Acad. Sc.*, 1948, *51*, 92). The substituted N is essential to activity and the ketonic and substituted nitrogen groups must be on the opposite sides of the diphenyl carbon atom if the activity is not to be entirely lost. Substitution of one or both phenyl groups decreases or abolishes activity.

A most noteworthy enhancement of activity is obtained when a methyl group is adjacent to the N-atom. The racemic mixture of the acetoxyl derivative is reported to be 30 per cent more active than methadone (Pfeiffer *et al. Fed. Proc.*, 1948, *7*, 255).



Considerable appraisals of amidone have been made in the past year (*J. Amer. Med. Ass.*, 1948, *136*, 920; *J. Amer. Pharm. Ass.*, (Pr. Pharm. Edit.), 1947, *8*, 536). It has been stated that there have been some near disasters in the use of physeptone in obstetrics (*Lancet*, September 6, 1947, 370) the child being adversely affected: but this may have resulted from inexperience in the use of the drug, especially of suitable dosage.

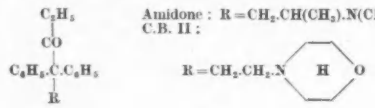
Amidone (Al-2-dimethylamino-4 : 4-diphenylheptane-5-one) has been scheduled under the Dangerous Drugs Act (S.R. & O., 1947, No. 2740) in this country and is subject to the provisions of the Federal Narcotic Control in U.S.A.

Wilson and Hunter (*Brit. Med. J.*, 1948, *No.* 4576, September 18, 1948, 553) report promising clinical trials of a new analgesic drug called "C.B.11." They consider that

it compares favourably with amidone (physeptone, etc.) and is more active than pethidine.

Somers, in a personal communication to the authors, had indicated that C.B.11 to be a more effective analgesic than morphine in rats and because of this and its low toxicity it was considered to be worthy of a clinical trial in man.

C.B.11 is said to be 4 : 4-diphenyl-6-morpholino-neptan-3-one. It will be seen therefore to be homologous with amidone, the dimethylamino-group of the latter having been replaced with a morpholino-group. As pointed out by Chen (*Ann. N.Y. Acad. Sc.*, 1948, *51*, 92) this is one of a series of variants on the amidone theme which is obtained when the "upper half" of the molecule is kept constant and variations are produced with the nitrogen atom in ring and chain form. Chen indicates that the morpholino derivative has 50 per cent of the activity of amidone for rats.



It has been remarked that the advance in the field of analgesics has been possible through the combination of more refined methods in organic chemistry, accompanied by a similar refinement in the quantitative determination of degree of analgesia. That is not to say that the latter is incapable of improvement in a very difficult field, where the character of pain differs widely and response to given stimuli are obscured by subjective effects.

The status of the study has been summarised by Millar (*Ann. of N.Y. Acad. Sc.*, 1948, *51*, 49), who has reached the conclusion that, for testing analgesia in human beings, the original Wolff-Hardy-Goodell method (*J. Clin. Invest.*, 1940, *29*, 649; *ibid*, 1940, *29*, 659) is best.

At best, however, the technique, using laboratory animals, is complicated for "screening" substances for analgesic properties and there is need for a simplified technique.

(To be continued)

Vauxhall Export Record.—During December, 1948, more products of Vauxhall Motors left this country for overseas than in any other month of the company's history: 5658 Vauxhall cars and Bedford trucks were dispatched during the month, representing a shipment of nearly 300 each working day.

American Industrial Chemicals

Nearly 10 per cent More than in War

REVIEWING the American chemical industry's activities in 1948, Mr Charles S. Munson, president of the Manufacturing Chemists' Association, and chairman of the executive committee of United States Industrial Chemicals, Inc., reported last week that production levels exceeded the peak wartime rate by nearly 10 per cent and that output of industrial chemicals was considerably more than four times the annual production in the years 1935-1939. The total value, Mr. Munson said, exclusive of such related products as drugs, plastics, synthetic fibres, and other allied products, is likely to be in excess of $3000 million.

In spite of the fact that some projects have been deferred because of mounting construction costs and material shortages, well over $2000 million went into new plants and facilities, said Mr. Munson.

Of the various categories, chief gains were registered from increased production of organic chemicals, particularly those produced from petroleum and natural gas.

For the first eight months of 1948, as compared with the same period of 1947, formaldehyde production averaged almost 20 per cent more; ethylene glycol 65 per cent, synthetic methanol 65 per cent; acetic anhydride, 20 per cent. Other high tonnage organics either advanced significantly, or maintained their position.

Inorganic Chemicals

The advance in inorganic chemicals was not so marked, although significant production increases were registered for chlorine, caustic soda, sulphuric acid, phosphoric acid, hydrofluoric acid and others, but a few large tonnage inorganic chemicals fell below 1947 levels.

Of the chemotherapy products, production of penicillin for the first eight months of 1948 was more than 160 per cent higher, while the output of streptomycin increased threefold. Production of new synthetic organic insecticides and fungicides exceeded prior output by several hundred per cent. The production of surface active agents also continued to mount.

Pointing out that the industry was able to meet the Government's stepped-up defence requirements without serious dislocation during the year, Mr. Munson anticipated that the still larger defence budgets now forecast, as well as the requirments of the European recovery programme, would place new strains upon industry as well as upon the Government's fiscal programme.

VITAL RÔLE FOR ANTRYCIDE

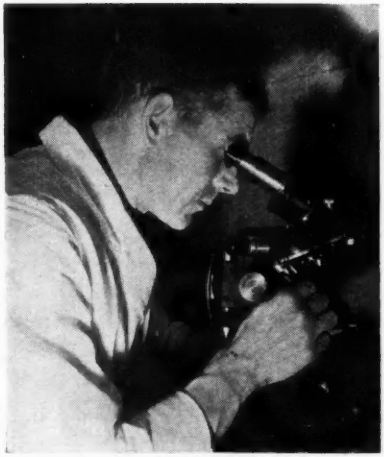
Large Claims for I.C.I.'s New Veterinary Drug

THE discovery of Antrycide, a new drug to protect cattle from the ravages of the disease spread by the tsetse fly, in tropical Africa, was announced last week by the Colonial Office in conjunction with Imperial Chemical Industries, Ltd.

The new drug was described by Mr. D. R. Rees-Williams, Under-Secretary of State for the Colonies, as one of the great advances of modern science. By its use, it was anticipated that some 4.5 million square miles in East and West Africa would be rendered safe for cattle raising.

The story began in Manchester in 1944 when a team of I.C.I. chemists and biologists, headed by Dr. F. H. S. Curd (who was killed in the Stockport railway accident in November last year), and Dr. D. G. Davey, were seeking a cure for trypanosomiasis in animals. Many synthetic chemical compounds likely to prove effective against the parasites in the bloodstream which cause the disease, were tried out.

Experiments on mice were made with a new drug, known at that time as M.7555, and when its value was fully appreciated the team of research chemists, with complete laboratory equipment, was sent to parts of Africa where the disease is endemic. Field experiments, in collaboration with the Colonial Office, were begun with laboratories based in Entebbe, Khartoum, and Nairobi.



Dr. D. G. Davey

The late Dr. F. H. S. Curd

It was found that cattle, horses, camels and other animals suffering from all forms of trypanosomiasis, even in the worst areas, were cured by Antrycide, which also had a prophylactic effect, but produced no undesirable reactions.

In East Africa and the Sudan trials showed that cattle were cured in a single treatment of the two worst forms of the disease *T. congolense* and *T. vivax*. Successful results were also achieved in cattle, horses and dogs against *T. brucei*, against *T. evansi* in cattle and against *T. simiae* in pigs.

The immunisation of cattle is still the subject of experiment, but in the majority of cases so far the new drug is reported to have secured protection against *T. congolense* for six months, and *T. vivax* for four to five months. Further information, on the period of immunity is necessary to ascertain how frequently cattle will have to be treated.

Antricide is a white crystalline powder, soluble in water and administered by hypodermic syringe, not necessarily by an expert. It is intended to give simple instruction to cattle-owners.

Two or three tons of Antrycide, sufficient to cure about two million animals, are expected to be produced by I.C.I. next year. Supplies at first, will naturally be limited and will be sent where the need is most urgent, to the Governments of Sudan, Kenya and Uganda.

Further field trials are to be conducted in the natural conditions in West Africa.

Postal Mementos of Chemical Industries

Realistic Reproductions of Typical Scenes

THE portrayal of various industries in stamp design continues to provide opportunity for artistic interpretation of subjects which are usually the field of economists and technicians. Examples of stamps picturing the coal and steel industries have already appeared in THE CHEMICAL AGE (October 9 and November 27, 1948), and the series is now enlarged by the chemistry and chemical engineering subjects of the postage stamps reproduced below.

Hitler's Head

Worthy of special attention is the excellent design of the chemical plant on the 60 c. value of a recent Belgian issue (first specimen, bottom row). There is particular interest, too, in the Saar 15 pf. stamp (middle top row). After the issue by the Allied authorities, it was discovered that the German designer, a member of the Hitler movement, had incorporated, upside down between the worker's legs, a small drawing of the Fuehrer's head. It is clearly discernible in the original.

Illustrated here (top row, left to right) are: Turks and Caicos Islands, ½d. (green) of current series, showing workers raking salt; Saar, 15 pf. (brown), released in 1947, depicting a scene in a steel foundry; Gold Coast, 3d. (blue), portraying a train loaded with manganese leaving a mine at Nsuta for the port of Takoradi. In the bottom row are, left to right, Belgium, 60 c. (blue-green), chemical plant, and 6 f. 30 c. (magenta), steel works, both appearing in the 1948 series of industrial stamps; Jugoslavia, 5,000 din. (dark blue and red), one of a series of three stamps specially issued to commemorate the Zagreb International Fair, held in May, 1948, at which many chemical engineers and industrialists were represented.

Paris Plastics Exhibition

Some of the latest British plastics will be displayed by De La Rue Insulation, Ltd., at the first plastics exhibition to be held in France since 1939. This will open shortly at the Pavillon De Marsan (Palais du Louvre) for five weks. Known as "Plastiques 49," this exhibition will be sponsored by the Union Centrale des Arts Décoratifs and the Société de Chimie Industrielle.

Table tops, tables, a hanging bookshelf and a wall section all of Formica, the De La Rue decorative laminated plastic will be displayed, with prize-winning exhibits at the American Plastics Exhibition, which were recently on show in this country.

THE MICROSCOPE'S 300 YEARS

Pioneers of Optics Commemorated

THE history of the microscope from its earliest form to the end of the nineteenth century is the subject of an exhibition which has been opened at the new premises of The Wellcome Historical Medical Museum, 28 Portman Square, London, W.1.

More than 300 years of research has gone into the production of the modern instrument, and it is deeply interesting to trace its development from the work of the early pioneers.

The exhibition follows a chronological sequence, starting with models to demonstrate the optical and mechanical principles involved and the difficulties which had to be overcome.

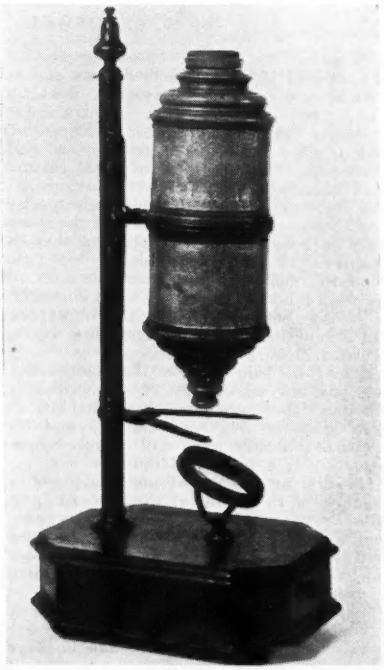
First came the compound microscope, invented about 1590, and generally attributed to Hans Janssen and his son Zacharias, spectacle makers, of Middelburg, Holland, and then in 1608 Galileo's form of telescope.

In the seventeenth century there were considerable developments in optics. In 1637 Réné Descartes in his book *Discours de la Methode*, gave the first published statement of the Law of Refraction. The *Micrographia* of Robert Hooke published in 1665 is of considerable value as in it he detailed many of his microscopical observations and gave a description of his instrument which marked a great advance on previous ones.

Christian Huygens, like many men of science, was not fully appreciated for many years; his *Wave Theory of Light*, communicated to the Academie de Sciences in 1678 was not generally accepted until the early part of the 19th century.

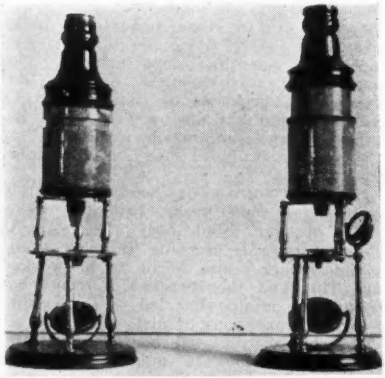
Then followed a number of now well-known men, who helped to make the microscope a practical instrument of scientific research—Nehemiah Grew, Marcello Malpighi, Anthony van Leeuwenhoeck who was the first to see protozoa and bacteria, and Sir Isaac Newton, who, in his *Opticks* 1704, described his discovery of the nature of white light and experiments on the spectrum.

A new era in microscopy came with J. J. Lister, who developed the achromatic microscope, so eliminating distortion and colour changes. His original drawing as well as the type of instrument made from it, are on view.



Modified form of Hooke's Microscope, early 18th century

[*Photographs on this page by courtesy of the Wellcome Historical Medical Museum*]



Original Culpeper microscopes. The design by Edward Culpeper between 1725 and 1730, introduced the first use of the concave mirror for reflecting and focusing light on the object

Fuel Problems of 1948

Organisational Experiments at a Critical Period

by G. E. FOXWELL, D.Sc., F.Inst.P., F.Inst.F.

IN an article entitled "Looking Ahead," published in the December issue of *Fuel Efficiency News*, the Minister of Fuel and Power has described the country's fuel problems in these terms: "Immediate action must be directed to dealing with shortages. We want more coal, cheaper coal, cleaner coal. We want more generating stations and more gas-making capacity. Until these aims are achieved such measures must be adopted as the control of the distribution of coal, particularly to the domestic markets; the encouragement of the use of lower grade fuels in this country to release better quality coal for export; and arrangements for the spreading of the electrical load."

It may be said at once that nationalisation has not solved any of our problems. Whether the problems would be less or more acute if the coal industry and the electrical industry were still operated independently is a matter of opinion.

The first annual report and statement of accounts of the National Coal Board, published earlier this year, made depressing reading. A loss of £23,255,586 resulted from the first year's working. If any financial improvement results from the operations of 1948—and a considerable improvement is expected—it will be because the price of coal has been raised. It is easy to balance accounts when prices can be fixed arbitrarily by a supplier possessing a monopoly.

Technical Measures

Criticism of the Coal Board does not imply condemnation of the technical measures that have been adopted by the Board. It is known that every effort is being made to improve conditions in the mines, to aid the miners to secure increased output, and to produce cleaner coal.

So urgent has been the need to produce more coal during the past two years that long-term plans have had to be deferred; during 1947, and perhaps even more markedly in 1948, the predominant characteristic of the Coal Board's work has been the drive for increased production.

Some collieries were in very poor shape and a great deal of make-do-and-mend has been necessary to enable them to pull even part of their weight. Machinery has been installed to replace the hand-getting of coal and this has involved training men in its use.

More face machinery and more haulage by substituting conveyors or locomotives for the old endless-rope tub haulages, and concentrating machinery and man-power on the most productive seams have been features both of 1947 and 1948. The use of more belt conveyors for the transportation of coal below ground has been an important part of the technical measures taken to increase output.

Much requires to be done in the form of long-term development to implement the Reid Report. These recommendations, made in 1945, have been broadly accepted by the NCB as its long-term plan.

"Horizon Mining"

They include the development of "horizon mining," in which straight, level, underground roads are driven through the strata; the introduction where possible of the "room and pillar" method of coal-getting; the maximum employment of coal-cutting and loading machinery; the replacement, where possible, of the existing method of rope haulage by locomotive and conveyor haulage; and the increasd use of electricity underground.

Each of the Area General Managers has had to survey his area and prepare plans for its development and modernisation, involving a review of existing plans and the formulation of new ones.

A great deal of research has been undertaken and the NCB has set up large and important scientific departments. This involves not only chemical and physical research on problems of coal preparation and utilisation but also a Production Research Organisation which is undertaking a very close study of many new technical developments.

The quality of coal has been deteriorating steadily for some years, primarily as a result of war conditions. There is a tendency towards working thinner seams, as the thicker seams begin to be worked out. This and the increased tonnage got by machine mining has led to the raising of larger proportions of dirt.

The shortage of coal has caused many consumers to tolerate qualities or sizes unsuitable to their purposes, and inferior coal (mainly fines and slurries), which before the war would have been dumped at collieries as unsaleable, has in recent years been bought and burned.

This is not in itself a bad thing, since no burnable fuel should be dumped; and another agreeable result has been to cause users and producers to investigate methods of burning with reasonable efficiency fuels which were discarded in times of plenty.

It is known that very large orders have been placed for new coal cleaning plant. The capacity of these plants was reasonable before the war, but under the new conditions of mechanical mining many washeries and dry cleaning plants are hopelessly overloaded with smalls and dirt; in effect they are doing a job for which they were not designed.

Cleaning

Few, if any, new cleaning plants were built during the war and many of the existing ones fell into a bad state of repair. The following table will indicate what was done prior to nationalisation:—

Year	Mechanically cut per cent	Mechanically conveyed per cent	Mechanically cleaned per cent
1930 ...	... 31	17	30
1938 ...	... 59	54	45
1946 ...	... 74	73	47

Altogether some 70-80 per cent of the total output is cleaned, either mechanically or by hand. It is the remaining 20-30 per cent—mainly unscreened run-of-the-mine coal and uncleaned smalls—which gives most of the trouble. While some coal sold contains only 2 per cent of ash, a figure of 30 per cent ash is not uncommon.

By the beginning of 1948, 45 new coal preparation plants with a capacity of about 14 million tons of coal a year (costing £5 million) were either under construction, on order, or had been put into operation during the year. Further considerable orders are known to have been placed in 1948, but the details have not yet been divulged.

It is known, however, that in addition to the 45 plants mentioned, 140 new coal preparation schemes were under consideration in January, 1948, intended to deal with about 60 million tons of raw coal annually, and costing between £20 million and £25 million.

In view of these figures, developments and plans, consumers of coal can look forward to progressive improvement in the quality of supplies. There is, unfortunately, no equal and progressive improvement in the output from the mines, and a recurrent feature of the news in 1948 has been the anxious attention paid to the organisation of the coal mining industry.

It was foreseen by many of those who, while admitting the need for reorganisation of all the fuel industries, doubted the wisdom of nationalisation, that personal contact would be lost through the setting-up of such a vast, impersonal corporation; and that unless the administrative arrangements were such as to leave the maximum of responsibility to the men on the spot with the minimum amount of direction from headquarters—whether national or divisional—initiative would be sapped and enthusiasm would die. This appears to have been the result of the type of organisation adopted by the National Coal Board.

Sir Charles Reid, the chairman of the committee that drew up the much-quoted Reid Report, resigned from the Board during the year because he did not consider that the administrative organisation was likely to be improved in the way that was necessary. When he resigned he said: "I believe that, with the manpower and the machinery now in the industry, at least 30 million extra tons of coal a year could be produced, provided that absenteeism were reduced to pre-war level, manpower put where it could be most effectively used, and men and managers alike were inspired to give of their best service to the country." In a later statement he has said: "There has been an all too ready acceptance of the false notion that more machinery is all that is needed and that hard work is out of date."

The conclusion which Sir Charles Reid has reached—and published in *The Times* in November last—is that the reason why production has not risen to any appreciable extent despite increased mechanisation is that "men now feel that they are part of a vast impersonal organisation, in which individuality is lost. The temptation, which is difficult to resist, is for management and men to be content to settle down as mere cogs in a huge machine They know that few people will be discharged for inefficiency, while individuality and enterprise, so much valued in former days, are no longer appreciated. . . . The result is an organisation which lacks both drive and decisiveness, where control is by committees, and managements are both frustrated and unhappy. The coal industry, instead of being alive and enterprising, is fast degenerating into a dull, mechanical firm of Civil Servants."

Administration

The NCB has appointed during the year a committee on organisation under Sir Robert Burrows which reported also in November. It remains to be seen what will be the result of the widespread dissatisfaction with the methods of administration and of the suggestions made in this report. Many believe that the report is far less drastic than it should be.

We have to remind ourselves that the organisation of the coal industry embraces all these: a headquarters staff in London; the coalfields are divided into eight divisions, each with a divisional chairman and offices, etc., at the head; these divisions are again sub-divided into 48 areas, each of which has an area general manager and a complete staff; and in these 48 areas are about 1000 collieries, each of which is in the charge of a colliery manager.

The essential problem, as the writer sees it, is to obtain the utmost decentralisation with the greatest practicable degree of responsibility at the bottom, leaving as few decisions as possible to the area general manager, very few decisions indeed to the divisional chairmen and boards, and only major policy and planning to the headquarters staff.

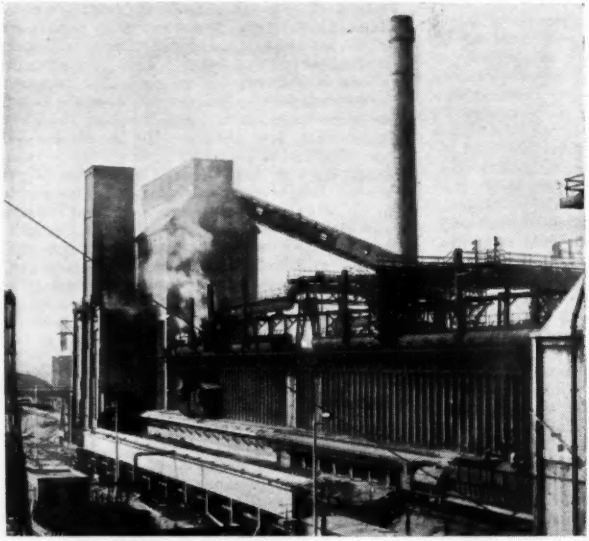
During the year, the electricity industry was nationalised and it was prudently decided to permit a much greater degree of decentralisation than in the coal industry. The Bill for the nationalisation of the gas industry was introduced into Parliament during 1948 and was passed through all its stages after a considerable Parliamentary battle in the Standing Committee. This Act, in the opinion of many, is a great improvement on any previous nationalisation measure, if only because it carries decentralisation to much greater lengths and in effect creates 12 large gas undertakings (area boards) which are autonomous, except that major policy is likely to depend on the deliberations of the Gas Council, a body of which the chairmen of the 12 areas are members.

There has been considerable discussion within the coal industry and between the coal industry and consumers of coal upon a price structure for solid fuels. Some adjustments have been made whereby the price of inferior coals has been lowered and the price of the better coals has been raised. Just what will be the ultimate price structure of the industry is not yet known.

It is, however, a matter of paramount importance to coal users, since it will determine the type of plant which they will install. It may, for example, pay a works to install a boiler plant that will use cheaper fuel for steam raising, as the alternative to purchasing dearer coal. Whether this new coal structure will be announced during 1949 is not as yet certain.

In the article by Mr. Gaitskell, to which reference has previously been made, he gave as one of his objectives of long-term fuel policy "sufficient co-ordination, both of production and consumption, to ensure maximum efficiency and lowest costs."

He elaborated this: There must be



The quenching tower and coal store of No. 3 battery of the new coke ovens at Beckton, of which a special feature is the provision of multiple air ducts beneath the waste gas flues for cooling the main concrete slab. The battery forms part of an expansion scheme costing £8 million which will take several years to complete. The three batteries at present in operation can carbonise 1800 tons of coal a day

co-ordination between the coal, electricity and gas industries: "for instance, the coke ovens of the National Coal Board produce gas, and the development of these coke ovens must be linked with the development of the gas industry." He added: "Some people think that co-ordination can and should be carried further; for instance, some feel that there might be advantages in locating power stations at or near pitheads, or in combining gasworks and power stations. Some feel that underground gasification of coal has great possibilities, particularly if associated with the gas turbine for generating electrical power."

One of the major criticisms levelled against the Ministry of Fuel and Power is that it has no national fuel policy and never had. It can be inferred from the foregoing statements of the Minister that he is ready to investigate—to put it no higher—the proper co-ordination of the *production* of fuels. That will be ineffective unless he is also prepared to exercise some control over *utilisation*.

Control should not be direct—we have all had more than enough of controls—but correct usage could be encouraged through the price structure of fuels. These and other problems are now under review by a new officer, Dr. Roxbee Cox, who has been appointed Chief Scientist to the Ministry, and by a Scientific Advisory Council set up during the year by the Minister.

Coal and Chemicals

The present writer has investigated the policy of the carbonising industries after nationalisation (*J. Inst. Fuel*, XXII, 32). The general conclusion is that the gas industry and the NCB coke ovens must be developed primarily as fuel industries, and only incidentally as chemical industries.

The production of chemicals from coal may take three forms: Existing products may be worked up into intermediates or even into finished products; synthetic chemicals such as ammonia and methanol may be produced from coke; coke-oven gas or coke can be converted into synthesis gas which then, by such means as the Fischer-Tropsch synthesis, is used to produce finished chemicals.

The possibility that the great nationalised fuel industries may take over completely the manufacture of certain chemicals from coal, including tar distillation, must not be discounted. The prospect cannot be viewed without alarm if only because there is no knowing how far such a movement might extend.

While there is an efficient group of independent manufacturers specialising in such industry—tar distillation, ammonia manufacture, benzol or the working up of by-products from ethylene—there is no question that they should continue to operate, using raw material provided by the nationalised industries. It may well happen, however, that a nationalised industry may, by its capacity for research due to its great resources, find that it can develop faster than established industries. What would then be the position?

Establishing Relations

Should not established industries and the nationalised industries come to some arrangement now as to their future relationship, both in regard to research and in the practical application of the results of research and of other new developments?

Ammonia seems to be in a category different from other established by-products from coal. The late Percy Parrish insisted that ammonia could be reconverted into a profitable by-product by building large central plants to which all producers within reasonable distance would send concentrated liquor—transport costs otherwise out weighing any savings made—to be worked up into a range of commercial products. It does not appear that by-product ammonia has yet been tackled on a sufficiently comprehensive or imaginative scale, and there might well be a case for the carbonisation industries to erect a few central ammonia factories if, on examination, Mr. Parrish's views are substantiated.

Ethylene is a potential by-product which the carbonisation industries might develop. Olefins are among the best building bricks for organic synthesis and the British chemical industry certainly has not yet made full use of them. The amount of ethylene potentially recoverable from coke-oven gas is probably of the order of 200,000 tons a year. Extensive chemical production could be based upon this valuable raw material.

Ethylene Recovery

There are grounds for apprehension lest chemical industry should have lost its chance in this field, through lack of initiative. It has left to others the responsibility and rewards of devising means of recovering ethylene, and has left to the petroleum industry the production of processes for the manufacture of chemicals from ethylene.

The coke oven industry has not troubled, so far as is generally known, to discover whether the chemicals that the American petroleum industry is already making from ethylene would be saleable in this country or in the export market in sufficient quantities and at an adequate price to render it profitable to extract ethylene and manufacture intermediates from it.

The petroleum industry, meanwhile, is

erecting vast refineries, and is now developing home refining on a large scale. The amount of oil that it is proposed to refine in this country is about equal to the total weight of coal carbonised by the coking industry or the gas industry. It is further intended to manufacture chemicals from petroleum on a large scale, and who can doubt that among the starting points will be ethylene?

Refinery gases that cannot be used for chemical manufacture will presumably be sold to the gas industry. Manchester Oil Refineries, for example, has already arranged to sell its surplus gas to Manchester Corporation gas department.

Whether coke-oven gas can be used for the production of synthetic methanol or ammonia is doubtful. There are considerable developments in this direction in Belgium and the Netherlands, but it would appear from such published information as is available that the price that could be paid for the gas for this purpose is a good deal less than that which it would command for town uses or as an industrial fuel.

The economic difficulties of chemical production from coke-oven gas have been illustrated by Dr. Levinstein (*Chem. and Ind.*, 1948, 537), who has pointed out that if coke-oven gas is sold at 1s. 6d. per 1000 cu. ft., on a CV basis, the methane it contains is worth 33.4d. per 1000 cu. ft. of CH_4; in contrast, the cost of methane in the U.S.A. is 0.7 per cent per 1000 cu. ft.

The question of pit-head carbonisation has been raised during the year. There is a school of thought which suggests that the gas that is needed for domestic and industrial purposes should be made in coke ovens at the pit-head. This proposal which was condemned on economic grounds by Sir Ernest Smith (*World Power Conf.*, 1928, III, 828), has been re-investigated by the present author (*loc. cit.*).

Winter Heating Load

The feasibility of the project depends on whether gas alone is to be transmitted, or whether both coke and gas must be sent from the coke oven to the townships. Obviously, for many years and perhaps as long as coal lasts, solid fuel will be required to take the winter heating load. The computation must therefore be made on the basis of sending from the pithead to the towns both gas and coke.

The general conclusion is that if coke has to be provided to meet winter peak or seasonal demands for heat on the same or a greater scale than now, pithead carbonisation can only be regarded as feasible under conditions of a densely-populated area, with carbonising plants scattered over the district at distances of a few miles, or when one plant supplies large quantities of gas to an area of 5-20 miles radius around it.

Long-distance transmission, in which the Midland coalfields might be required to supply gas and coke to the South of England, is uneconomic. If a smaller proportion of coke is supplied with the gas, the economic distances for gas transmission become greater, but total gasification alone is not an acceptable method of enabling pit-head carbonisation to become economic.

Instead of balancing the transmission costs of 15,000 cu. ft. of gas and 0.5 tons of coke against one ton of coal (in effect, 15,000 cu. ft. of gas against 0.5 tons of coal), the balance would be between about 40,000 cu. ft. of gas (200 therms), or even more, and one ton of coal.

Underground Gasification

Not much has been heard during the year about underground gasification. It seems to be pretty well accepted that this system is only feasible under certain conditions, and that at present these conditions do not exist to any appreciable extent in Britain.

District heating has been in the news, and the advocates of this system of central heating (with hot water supply) by means of hot water or steam have been active in urging the merits of their system. The electrical industry does not appear to have any marked enthusiasm for linking power stations with district heating units, and it appears difficult to justify district heating under other conditions.

It seems to be impossible to secure independent and exhaustive figures for the cost of operation, including capital charges, etc., for a district heating scheme. Would it not pay the National Coal Board to equip, perhaps, a considerable mining village with an up-to-date district heating system in order to obtain authoritative figures on the merit of the system? The housing authorities could be expected to bear part of the cost of so valuable an experiment.

A final word must be said about the Fuel Efficiency Branch of the Ministry of Fuel and Power. This year has produced events that may well prove detrimental to the future of the work. The Fuel Efficiency Committee has been disbanded and re-constituted on a wider basis, but now meets so infrequently that it is difficult to see how it can exert much real influence.

Dr. MacFarlane, the director, has gone to the U.S.A. as director of the United Kingdom Scientific Mission. The chief engineer, Mr. J. R. Mason, has returned to industry. The many industrial engineers, chemists and business men who have given so large a part of their time to promote fuel efficiency have also returned to

industry. The Technical Sub-committee which produced over 50 first-class Fuel Efficiency Bulletins, has been disbanded.

This does not mean that the work will cease. There is still much to do. The Regional Advisory Service has been put on a permanent basis through the engagement of full-time engineers—who now become Civil Servants. The educational programme of the Ministry is to be continued, and it is hoped that it, too, will be placed on a permanent basis.

Perhaps the time has come to cease special courses and odd series of lectures, and instead to enroll students who will proceed to examinations, first of the City and Guilds of London Institute and, in their more advanced stages, the membership examinations of the Institute of Fuel.

The Education Sub-Committee has been re-established under the chairmanship of Prof. R. J. Sarjant, of Sheffield, who has been chairman for many years. The effectiveness of the work of this committee would be greatly improved if there were provided a national certificate in fuel technology, to serve as the equivalent of Section A of the Institute of Fuel examinations and as an entrance examination to the Institute of Gas Engineers Associateship examination.

The relationship between fuel and chemical engineering is close; the fuel technologist and the gas engineer can well be regarded as colleagues of the chemical engineering profession. It is therefore not readily intelligible why the Institution of Gas Engineers should take the view that the gas engineer is a civil engineer by linking its examinations to those of the civil and electrical engineers, rather than to those of the Institution of Chemical Engineers.

This country needs more technical men and more technically trained operating staff. To secure this object there must be adequate incentives for students in the form of immediate benefit to the individual. That is primarily a responsibility of employers and one which cannot much longer be ignored without very serious results.

Board of Trade Changes

IN answer to a question in the House, the President of the Board of Trade recently announced his decision to amalgamate the Commercial Relations and Treaties Department and the Export Promotion Department into a new department to be known as the Commercial Relations and Exports Department.

The objects of this change, which took effect on January 1—says a Press note from the Board of Trade—are to ensure that both trade policy and matters of trade promotion are the responsibility of a single department in the Board of Trade, that overlapping and underlapping alike are avoided and that the fullest and promptest use is made of the information and advice available from overseas officers.

No contraction of the functions of either department is contemplated. The change involves no alteration in the existing practice under which the Board of Trade maintains direct contact with officers in the commercial diplomatic and consular posts on all matters for which the Board of Trade is responsible and with the United Kingdom Trade Commissioners in the Commonwealth who form part of the Board's staff. But it should help the overseas officers in giving them a single point of contact on trade matters at home, which will be the appropriate geographical branch formed by the merger of the country branches hitherto existing both in CRT and EPD.

The position of the various Government production departments in relation to the overseas work of the Board will not be affected. It is, however, intended that the change should bring even closer co-operation between the new Commercial Relations and Exports Department and the Production Departments on matters of interest to both.

The offices of the geographical sections are at I.C.I. House (Tel. : Whitehall 5140) and the Industries Branches and the Reception and Tours Section at Thames House North (Tel. : Victoria 9040). The Exhibitions Branch will remain at Horseferry House (Tel. : Victoria 6800).

Laboratory Explosion.—Damage estimated at several thousand pounds was caused by an explosion on December 30, in the research laboratory of the Manchester paint and chemical works of E. J. R. Lovelock, Ltd., in Silk Street, Oldham Road, New Cross. It is understood that experiments were being carried out on a varnish preparation in the laboratory when the explosion occurred. Many minor explosions followed and large drums of oil became ignited. There were no casualties as all the laboratory assistants had left before the explosions, but half the roof of the works was destroyed, the rest damaged, and the contents of the top floor and that below were seriously damaged.

The Quest for Synthetic Fuels

U.S. Research Director's Review

RADICAL new process improvements now under development in the synthetic liquid fuels laboratories of the U.S. Bureau of Mines at Bruceton, Pennsylvania, seem now to have brought very much nearer the prospect of transferring a part of the growing burden of oil and gasoline demand to the U.S.A.'s immense coal reserves. One of the most informative reviews of the present stage reached in this project, to which so many references have been made in the past, has now been given by Dr. H. H. Storch, chief of the Bruceton Laboratories.

Acknowledging receipt of the Pittsburgh Award of the American Chemical Society, Dr. Storch recalled that the present coal to oil research activities depended upon fundamental improvements in the Fischer-Tropsch gas synthesis process and on a basically new approach to the direct hydrogenation or Bergius-I.G. Farben process.

Fischer-Tropsch Research

In the Fischer-Tropsch process, he observed, synthesis gas constituted 60 to 70 per cent of the cost of the liquid fuel product. It was apparent, therefore, that very efficient conversion of the synthesis gas to liquid products was necessary.

To this end, two methods were being studied by which a high yield of oil and a low yield of hydrocarbon gases are obtained. In one—the internally-cooled, fixed catalyst-bed method—the heat of the synthesis reaction was efficiently and rapidly removed by circulation of a relatively non-volatile oil through a bed of catalyst granules. In the other—the "oil-catalyst slurry" method—a powdered catalyst was suspended in an oil that is non-volatile under operating conditions, and the synthesis gas was bubbled through this suspension.

Dr. Storch reported that the internally-cooled method yields about 30 per cent more oil than the more widely known fluidised-iron catalyst method with the same volume of synthesis gas. The "oil-catalyst slurry" method, however, offered still greater advantages. It produced only one-quarter to one-half as much gas and delivered a high yield of the more desirable liquid products.

Both the internally-cooled and "oil-catalyst slurry" converters were being incorporated into the Bureau's new gas synthesis demonstration plant now under construction at Louisiana, Missouri.

Departing from the conventional high-pressure hydogenation process in some phases of its research, the Bureau of Mines—said Dr. Storch—is seeking a rapid conversion of coal to distillable oil, gas, and coke at moderate pressures and relatively high temperatures. Parallel objectives are the reduction in the two major cost items of this process: (1) hydrogen, which now constitutes 50 per cent of the total cost of the liquid fuels, and (2) capital charges on the investment and maintenance equipment.

Laboratory research has shown that hydrogen costs may be reduced, either by replacing hydrogen with water gas under appropriate operating conditions, or by using by-product hydrocarbon gases for hydrogen production. Estimates of the economies which may be expected from these alternatives are now being made by the staff of the Bureau's demonstration plants.

"A third procedure, which should result in a lower cost of hydrogen as well as of equipment," Dr. Storch said, "consists in passing about twice as much coal through the hydrogenation plant as is hydrogenated. Thus, about one-half of the coal feed is converted to oil and gas and the other half to coke. The latter is burned for steam and power production. In this way, all the available hydrogen in that half of the coal feed which is converted to coke appears in the oil and gas."

Combination of several of these procedures may well result in a much cheaper coal hydrogenation process, he considered. It was also probable that a new process would result from work now being done on the action of solvents on coal. At this stage, its development depended largely upon the discovery of suitable catalysts for hydrogenation of the coal solution.

Canada's Uranium Mines

In a move to encourage private prospecting for uranium in Canada, Mr. C. D. Howe, the Trade Minister, last week announced that two years have been added to the period in which the Government would guarantee a floor price for uranium. The Government-owned Eldorado Mining and Refining, Ltd., will buy acceptable ores and concentrates with a minimum uranium content equivalent to 10 per cent by weight of uranium oxide. The guaranteed minimum price is $2.75 per lb. of contained uranium oxide, f.o.b. rail.

NITROGEN NEEDS STILL RISING

Agricultural Use at Home and Abroad

THE great increase since 1938-39 in world production of fixed nitrogen, which is still insufficient to cover the annual consumption figure, is revealed in the authoritative annual review—the 28th—of the British Sulphate of Ammonia Federation for the year to June 30 last.

The federation's analysis shows world output of pure nitrogen to have been (in metric tons) 3,332,800 and consumption, 85 per cent of which was as fertiliser, 3,358,000. These figures, however, take no account of production or use in the U.S.S.R., North Korea and Manchuria. Comparative figures in 1938-39 were 2,964,100 and (consumption) 2,958,100 metric tons. In the interval, America has become by far the largest nitrogen producer, 1,559,600 metric tons in 1947-48, which compares with 1,508,100 for the whole of Europe. The United Kingdom (321,600 metric tons) and France (176,400) were the largest individual producers in Europe.

The affairs of the United Kingdom industry are reflected in the federation's analysis of the production, at selected periods from 1913 to 1947, of ammonia products and ammonium sulphate. Part of this table is reproduced here.

The federation's review of the influences affecting the distribution of nitrogen products during the year (to June, 1948) lays emphasis on the increasing requirements of agriculture and the more intelligent use being made of such chemical fertilisers.

As a result of grassland developments and a further expansion in the use of fertilisers on arable crops, nitrogen consumption during the year was the highest ever achieved in this country, the federation observes.

The increased use of compound fertilisers on arable crops is stated to have had a marked effect on the distribution of sulphate of ammonia. The tendency to increase the nitrogen content of compound fertilisers has been mentioned from time to time in previous reports as one of the reasons for the expansion in the use of sulphate of ammonia. In 1938-39, federation sales to compound fertiliser manufacturers were 82,000 tons: in 1947-48 they were 333,600 tons.

The nitrogen content of compounds has remained steady during the last few years and the record figure of sales of sulphate of ammonia to manufacturers during the year under review is due to the expansion in compound fertiliser manufacture.

The fertiliser manufacturers have broken all previous records with a production of

(*Continued overleaf*)

Total output of ammonia products (tons of 2240 lb.) basis 25 per cent ammonia (about 20.6 per cent nitrogen)

	England and Wales	Scotland	Ireland	Total Gt. Britain and Ireland	Included in the total: Industrial ammonia products (basis 25 per cent ammonia) about	Included in the total: Sulphate of ammonia as such (actual) tons of product about
1913	298,300	122,900	2,700	423,900	66,000	365,000
1939	697,300	72,400	2,800	772,500	182,700	483,300
1944	1,197,300	229,300	2,600	1,429,200	154,700	779,500
1945	1,171,600	202,000	2,000	1,375,600	159,900	760,400
1946	1,216,500	211,200	2,300	1,430,000	152,500	833,700
1947	1,161,900	162,000	1,800	1,325,700	132,500	796,700

AGRICULTURAL CONSUMPTION IN THE BRITISH ISLES

Fertiliser Year	Sulphate of ammonia Tons of 2240 lb. England Wales and Channel Islands	Scotland	Ireland	Total	Nitrogen Metric tons N. Sulphate of ammonia 20.6% N.	Nitrogen in other forms	Total nitrogen
1913/14	—	—	—	60,000	12,558	12,598	25,156
1918/19	—	—	—	269,000	56,301	3,937	60,238
1923/24	79,600	41,000	21,800	142,400	29,804	7,874	37,678
1930/31	97,100	39,000	28,100	164,200	34,366	10,570	44,936
1938/39	134,316	38,756	42,465	215,537	45,111	23,537	68,648
1943/44	515,881	112,121	37,278	665 280	139,240	43,692	182,932
1945/46	418,255	97,678	38,860	554,793	116,116	50,308	166,424
1946/47	417,250	99,618	39,195	556,063	116,382	50,616	166,998
1947/48	486,000	112,500	63,000	661,500	138,450	52,950	191,400

over 1.5 million tons of compounds during the year. These results in the first year of the Government's agricultural expansion programme indicate that the demand for sulphate of ammonia in the home market will continue to expand, says the report.

Exports

The total shipments of sulphate of ammonia from the United Kingdom last year, and some previous years, are shown separately. During 1947-48 the Board of Trade, in collaboration with the International Emergency Food Committee, continued to allocate tonnages of British sulphate to be shipped to overseas markets.

Of the total U.K. shipments of 240,598 tons (247,801 in 1946-47), the largest proportion, 76,313 tons, again went to India. Pakistan and Burma, and Ceylon, 38,349 tons was also again the second largest purchaser.

The federation's research department has continued to deal with members' individual manufacturing problems. In addition, there have been regular meetings with members' technical representatives. Special attention is being given to materials of construction with a view to reducing maintenance costs. Experiments on a wide range of materials are in progress. Laboratory work aiming at improved methods of operational control is also proceeding.

Since 1934-35, summer prices of 20.6 per cent N to British farmers have been increased by 1s. 6d. per ton per month up to the spring price. Since 1940-41, prices to farmers have been "pegged" and producers have received a subsidy on home agricultural sales to cover increases in cost not included in the price. Prices were increased by 1s. per ton for 1946-47 and 5s. per ton for the last nine months of 1947-48 to cover increases in railway freight rates. The summer price in 1947-48 was £9 12s. 6d. and the spring price £10 8s.

Better Water Treatment : Progress in Anion Exchange

RESEARCH workers at the Resinous Products Division of the Rohm and Hass Company, Philadelphia, following an 18-months' laboratory and field investigation of Amberlite 1R-4B, have announced new operating data widening the scope of the use of the high-capacity, weak-base anion exchanger and effecting important processing economies.

Advances now found to be practicable include virtually 100 per cent improvement in effluent quality by the use of more basic regenerants, without impairing the resin's stability; a 50 per cent increase in flow rate without objectionable effect on exchange capacity or effluent quality; and a 10° extension, to 105°F., of previous temperature limitations.

In early work with weak-base anion exchangers, various basic regenerants were investigated, but no range of effluent quality was specified and the economics of anion exchangers were not clearly defined. Most of the field-unit operating data accumulated were based on the use of soda ash as the regenerant.

More recently, however, as ion exchange principles were applied to more and more large-scale operations, the importance of economy and effluent quality increased. The importance of the 1R-4B exchanger with both caustic and ammonia as regenerants was closely investigated.

Prolonged, continuous laboratory cycling with these reagents and 18 months' field study of the effect of caustic, have revealed no measurable difference in the stability of 1R-4B, whether treated with sodium hydroxide, ammonia, or soda ash.

Results of the study are said to confirm that a treated water of higher quality can now be obtained by using a more basic regenerant such as sodium hydroxide. Effluent quality is essentially doubled at equivalent regeneration levels.

These more efficient regenerants lead to processing economies, depending on the application or the locality of the operation. In beet sugar refining, for example, the research workers pointed out, where the quantities processed require large volumes of regenerant chemicals, anhydrous ammonia is said to offer definite operating economies.

Census of Distribution, 1949

Wholesalers, merchants, and brokers are included in the categories from whom returns will be required in the first national Census of Distribution and Other Services, planned for 1950, in respect of the year, 1949.

Certain information will be required for the calendar year 1949, but in the case of traders for whom it would be inconvenient to furnish returns regarding the calendar year because their business year does not coincide with it, a return may be made for the business year ending between April 5, 1949, and April 6, 1950.

Forms will normally require to be returned completed by March 31, 1950.

MEASUREMENT OF RADIOACTIVITY

Isotopes Require Uniform Standards of Comparison

THE determination of the number of radioactive atoms in a sample of a radioactive isotope has become a matter of importance, because these isotopes not only have become an article of commerce but are used also in biological and medical experiments, and in clinical treatment of diseases. Uniform quantitative results in all laboratories can be obtained only by using procedures that will yield absolute measurements or by the use of uniform standards of comparison that will give the same result whenever the determination is made, states the Director of the U.S. National Bureau of Standards, in some notes communicated to the *Journal of the Franklin Institute*.

The National Bureau of Standards has therefore issued standard samples of radioisotopes whose radioactivity has been accurately determined, and is planning to issue samples of additional radioisotopes as they become available. This follows logically the active rôle which the bureau has long taken in the field of radioactive standards and measurements. It is furthermore in line with the bureau's responsibility to furnish standards for precision measurement in all branches of the physical sciences.

Two factors are involved in the preparation and use of these samples. First, methods and standards that are correct in principle must be used. Second, a reasonable degree of accuracy must be attained in all steps of the process both of producing and of using the standards.

Measurement

Essentially, the measurement of a sample of radioisotope is the measurement of the number of radioactive atoms present. This, in turn, is dependent on the rate of disintegration, that is, the number of nuclear particles which are emitted in unit time from all atoms disintegrating within this interval of time. Counting the total number of disintegration particles, however, is not a simple procedure. The principal difficulty arises from the fact that these particles are emitted equally in all directions. It is therefore practically impossible to devise detecting equipment that will record all of them. Most of the difficulties in making quantitative determinations of radioisotopes, however, can be eliminated if standard sources of the isotope are available.

A standard source consists of a preparation of the isotope in a form convenient for use with the detector of radiation, and for which the disintegration rate is known from previous calibrations. When the isotope to be measured is the same as that from which the standard is prepared, reliable results may be secured by observing only a few simple precautions. Other isotopes which have short half periods and a known disintegration scheme may also be measured with fair accuracy by means of beta-ray standards if it is known that a beta ray or a positron is emitted for every disintegration, and if the maximum energies of the beta-ray spectra of the standard and of the specimen are not too widely different.

Other Standard

In the case of those isotopes for which a disintegration scheme is lacking, or for which the mode of disintegration does not permit measurement of disintegration rates, an alternative method of comparing the activities of sources is available if the isotope emits gamma rays. Although this method does not give disintegration rates, it can, when properly applied, yield reliable comparisons of sources in various laboratories. It is limited, however, to comparisons of the same isotope. To secure reliable results, a standard instrument and standard geometry are necessary. The röntgen is a convenient unit of gamma radiation which is defined without reference to the energy of the gamma ray.

An ionisation instrument properly designed to measure röntgens will therefore satisfy the requirements for a standard instrument. To determine the strength of a radioactive source the röntgens per unit time must be measured at a standard distance. On the basis of these considerations, bureau scientists have proposed that the unit of time be one hour and the distance one meter, giving as a unit for comparison of gamma-ray sources the röntgen per hour at a meter (abbreviated rhm).

At the same time the name Rutherford (rd) has been proposed for that quantity of radioisotope which disintegrates at the rate of a million disintegrations per second. This unit, which is smaller than the classical *curie*, can be specified exactly and independently of natural constants such as the rate of decay of radium, which is the basis for the definition of the curie. The National Bureau of Standards has adopted an arbitrary value of 3.700×10^{10} disintegrations per second for the curie when applied to isotopes other than members of the radium family.

[*The wider aspects introduced by the nuclides are the subject of a review appearing on page* 74.]

Powder Metallurgy in 1948

By R. A. HETZIG

POWDER metallurgy is still somewhat of a novelty in this country. While a number of firms make carbide tools and bronze bearings few otherwise specialise in the manufacture of sintered materials. Yet many new applications appear each year, and there is a marked trend towards the use of powders in fields where alloys with special properties are required.

Costs

It will be obvious from the literature that private firms and Government agencies all over the world are experimenting with metal powders, the most conspicuous developments at present being the high-temperature materials for jet engines and special powders for permanent magnets. Metal powders cost more than cast metals, though the difference has to be established from case to case, and they will naturally be preferred only when they provide materials which cannot be manufactured at all, or so easily, by other methods or when particular economics can be effected through mass-producing small parts without scrap.

The fundamentals of the pressing and sintering processes are now beginning to be much better understood, and the possibility of new developments arising from academic research should also not be overlooked.

In the year under review powder metallurgy was discussed at two meetings, one[1] held by the AIME in New York last February and the other[2] in Graz, Austria, last July, for which the Society of Austrian Chemists and the Metallwerk Plansee, Reutte, were jointly responsible. Both meetings were important in their several ways.

The New York meeting was an all-American affair, with five papers and a very good discussion, while at the First International Powder Metallurgy Conference in Graz a total of 65 papers was presented before a gathering representative of almost all powder metallurgy interests in this country, Europe and the United States. The emphasis was to a certain extent on the academic side, but the conference fulfilled a most useful function in bringing the various experts together in person.

The BIOS investigations of German industry came to an end in the course of the year, and a series of short Overall Reports is now being published by H.M. Stationery Office. These are to summarise both the status of German industry during the war and the enormous BIOS effort put forward in compiling the original data from German sources. The Overall Report on powder metallurgy will appear as No. 20.

Two new books have been published, one in English[3] and one in German[4]. Both are very good, and in fact the bibliographical side of powder metallurgy is by no means its weakest. A monthly abstracts journal[5] dealing solely with developments in this field is now in its third year of publication.

Americans[6] have made no effort to conceal the fact that they are conducting extensive research on metal-metal oxide powder mixtures for making turbine blades and other jet parts, among other things, for unconventional types of aircraft. The most promising results appear to have been obtained so far with nickel-magnesia[8] and with chromium boride[9] bonded with nickel alloys, though alumina and beryllia with up to 30 per cent chromium, nickel or iron have also been tried[7].

Similar work is doubtless proceeding in this country, and if published data are scanty, the reason may be either security restrictions or the need for accumulating more knowledge of the fundamentals.

Service conditions are extremely severe, and it is necessary to take into account not only the creep resistance of the materials and all the factors contributing to it, but also the methods of manufacture which may involve a much more complete knowledge of the mechanism of sintering than perhaps exists at present.

The California Institute of Technology[10] has issued several papers on "sweat-cooling" in which a cooling fluid is passed through porous nickel-molybdenum-iron or stainless steel. It is too early to say whether this method has possibilities, but in the discussion of one paper on the subject at the New York meeting the General Electric Co.[11] disclosed similar work. The only difference was that the CIT used ammonium bicarbonate for producing the porosity, while the G.E. sintered loosely heaped powder.

British Authorities

At the Graz conference five out of the nine papers presented at the Carbide Session were given by British authors,[2] and the full text of the proceedings should be most informative. From a general point of view, the paper by A. E. Oliver and collaborators was remarkable, as it discussed in considerable detail the causes of defects arising from manufacturing conditions.

It is precisely this information on tech-

nical "know-how" that is so urgently required in powder metallurgy work, and even in America some people[12] are now beginning to think that a little less secrecy would be advantageous to all concerned.

Quite recently, a paper by Burden Barker[13] has furnished a similar example of giving away what would formerly have been called "manufacturing secrets." It appears that the very abstruse question of particle size measurement can be solved by taking a Spekker reading of the tungsten powder, or of the ball-milled carbide or carbide-cobalt powder, and this reading will serve as a guide to the hardness of the finished carbide tool.

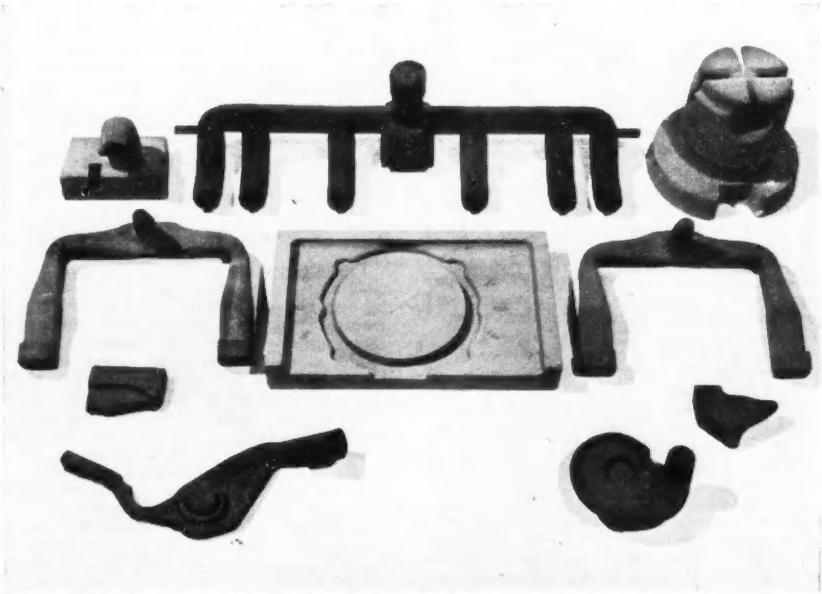
Sintered Magnets

Carbide manufacture generally has reached a very high standard, especially in this country; and, while one author[14] thinks that further progress in tool manufacture is rather a matter of design than powder metallurgy, another[15] considers that the quantity of carbides used for rock drilling will soon exceed the consumption of all other uses.

Progress in the production of sintered magnets has been stimulated by a better understanding of the theory of ferromagnetism. Stoner and Wohlfarth[16] here, and Néel[17] in France have developed independently of one another a new "single domain" theory according to which the coercive force above a certain limit is caused not by internal stress variations, but by a magnetic anisotropy of "single domains." These are minute areas of magnetisation, the size of which may coincide with that of sufficiently fine particles.

The whole position is in the patent stage at the moment, and nothing definite has been published, but in France[18] such powders have been prepared by chemical methods, *i.e.*, by reduction of iron or cobalt or mixed formates, among others. In America[19] a different method of producing high-coercivity oxide powders is being tried, namely, by treating a 50 :50 iron-aluminium alloy with caustic soda, *i.e.*, the Raney process applied to iron.

The BIOS investigations[20] have shown what can be done with sintered iron when the demand exists. Germany had not sufficient copper for making shell driving bands and resorted to sintered iron bands.



A representative assembly of the many highly varied components for industrial use and moulding aids which are now being produced, using a synthetic resin binder and powder metal alloys

(Courtesy of Aero Research, Ltd., and the Northern Aluminium Company)

The powder was made mainly by eddy mill grinding in Hametag mills, and was mixed with atomised powder made by the D.P.G. disc process or the RZ process. The latter was a straight air-atomised method, while the former comprised combined atomising of molten metal and beating of the atomised stream of semi-molten particles by rapidly rotating knives. The total figures for the entire war years were approximately 100,000 tons of iron powder and 1000 million shell bands. This adequately indicates the potentialities of powder metallurgy when it is applied on a really large scale.

Sintered Iron and Steel

Kieffer and Hotop's book[1] is a very valuable collection of all the available data on sintered iron and steel manufacture. At Graz they also gave a paper on sintered manganese steels and chrome-manganese steels, both impregnated with copper alloys. This field is as yet relatively unexplored, but some work has also been done in America[21] on sintered nickel steels made with incomplete diffusion.

Opinion on the merits of such materials is still divided,[11] but it seems[22] that the American automobile industry is fully alive to the production possibilities of powder metallurgy. The 1949 American Ford, Mercury and Lincoln cars are to have a greatly increased number of components made from powders, and these are to include even some structural parts.

One quite novel development mentioned in the patent literature[23] is the fabrication of self-locking nuts either partially or entirely by powder metallurgy. A magnetic fluid clutch, developed by the U.S. Bureau of Standards,[24] consists of a suspension of carbonyl iron powder in oil. When the powder is magnetised, it agglomerates and produces friction between the opposed rotating surfaces of the suspension container.

Some attention[25] has also been given to the design of completely self-contained plants for making small parts, such as bearings and ratchet parts for small electric clocks. The price of these plants is in the neighbourhood of $3000-5000.

A similar development[26] was announced in this country when a firm advertised the manufacture of plants for making tungsten carbide tools, complete with instructions. Only experience can show whether these are healthy developments or not. They certainly reflect contemporary enterprise in at least one industrial field.

Academically, the Graz conference was extraordinarily rewarding.

Hüttig's theory is that powders undergo a series of activations and reactivations at certain temperatures corresponding to fractions of the absolute melting temperature of the metal. It has been borne out especially in later work on iron powders,[27] and in his experiments a whole series of other metals was also used.

Hedvall's work on surface chemistry[2] is most interesting, but it appears to be applicable rather to oxide powders.

New Theory

A paper by Kingston[2] which has received very little attention, should merit further study. This author seeks to explain the combined pressing and sintering processes as a continuous process of self-diffusion induced by a lowering of the total free energy of the system.

There are many attractive points about this theory, and the author was able to support it experimentally by showing that crystal growth occurred during the prolonged pressing of molybdenum powder and also that the density increased steadily over a sintering range of 500° C.

Several interesting theoretical papers have appeared in America. Lenel[28] collected all the literature on sintering in the presence of a liquid phase. The discussion of this paper was very good.[12] Shaler and Wulff[29] worked out the rate of shrinkage that occurs during sintering from surface tension, entrapped gas pressure and pore size effects. Kopelman and Gregg[30] measured the porosity of hydrogen-reduced tungsten powder by density measurements in liquids of varying molar volume, and they were also able to show that the porosity of the powder diminishes with prolonged heating.

Miscellaneous Uses

Platinum alloy catalysts[31] for hydrogenation have been made with an incorporated base metal as activator. A Fischer-Tropsch catalyst[32] for use under very much less temperature-sensitive conditions than usual is described in a patent, nickel chromite being reduced by hydrogen to the alloy. The U.S. Bureau of Mines[33] has published a report on German electrolytic zinc dust for hydrosulphite manufacture and the hydrogenation of vinylacetylene to butadiene.

There are two good papers on flake powders.[34] Lastly, other developments worth mentioning are the use[35] of iron-base powder for flame-cutting stainless steel and a process[36] for precision grinding in which the abrasive effect is produced by exposing the sintered tool containing the abrasive particles to magnetostriction or ultrasonic waves.

(*Continued at foot of facing page*)

Production and Stocks of N.F. Metals

THE following particulars of production, stocks, consumption, imports and exports of non-ferrous metals in the United Kingdom in November are extracted from the monthly figures supplied by the British Bureau of Non-Ferrous Metal Statistics.

UNWROUGHT COPPER

	Long Tons	
	Blister Copper	Refined Copper
OPENING STOCKS:		
Govt. and consumers' stocks ...	39,995	80,782
Imports into U.K.	7,300	16,594
PRODUCTION:		
Primary	—	8,723
Secondary	1,831	6,564
CONSUMPTION:		
Primary	8,780	29,530
Secondary	—	14,101
EXPORTS FROM U.K.	1,602	35
CLOSING STOCKS:		
Govt. and consumers' stocks ...	37,233	78,420

GROSS OUTPUT OF MAIN COPPER, ALLOY AND PRODUCTS

Unalloyed copper products	26,320	long tons
Alloyed copper products	24,519	„ „
Copper sulphate	3,635	„ „

UNWROUGHT ZINC

	Long Tons	
	Zinc in Concentrates (estimated gross zinc content)	Slab Zinc (all grades)
OPENING STOCKS:		
Govt. and consumers' stocks	14,398	55,388
Imports	3,656	8,686
PRODUCTION:		
Virgin and remelted	—	5,848
CONSUMPTION:		
Virgin (incl. debased)	6,426	18,731
Remelted and scrap	—	7,212
EXPORTS	—	56
CLOSING STOCKS:		
Govt. and consumers' stocks	11,628	49,905

LEAD

	Long Tons			
	Lead in Concentrates	Imported Virgin Lead	English Refined	Lead Content of secondary scrap and Residues
OPENING STOCKS:				
Govt. and consumers' stocks	—	12,361	1,208	—
IMPORTS ...	18	20,835	—	—
PRODUCTION ...	155	—	3,783	—
CONSUMPTION ...	173	16,699	3,015	11,319
EXPORTS	—	150	—	—
CLOSING STOCKS:				
Govt. and consumers' stocks	—	19,427	1,976	—

TIN METAL

	Long Tons
GOVT. AND CONSUMERS' STOCKS AT END OF PERIOD	11,808
IMPORTS	1
PRODUCTION	2,419
CONSUMPTION	1,991
EXPORTS AND RE-EXPORTS	375

ANTIMONY

	Long Tons
TOTAL CONSUMPTION OF ANTIMONY METAL AND COMPOUNDS	462
TOTAL CONSUMPTION OF ANTIMONY IN SCRAP	343

CADMIUM

	Long Tons
TOTAL CONSUMPTION OF CADMIUM ...	47.50

POWDER METALLURGY IN 1948

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WELDED PRESSURE VESSELS

Endurance Tests Under Operational Conditions

THE work which is being carried out at the Cambridge University Engineering Laboratory, and at the Research Station, Abington, with a view to solving the problems of welded pressure vessels, was described by Mr. Nicol Gross, of the British Welding Research Association, at a recent meeting of the North London branch of the Institute of Welding.

Mr. Gross described the first welded pressure vessels, introduced around 1925 in the U.S.A. in cracking plants of oil refineries, where they were expected to operate continuously at 900° F. and 600 p.s.i. Failures were inevitable, but as it was soon realised that this new type of vessel had been put to such severe tests prematurely, its development was not arrested, nor was the extension of its use.

Boiler Drums

In reviewing briefly the advantages of welding as opposed to riveting for boiler drums, it is observed that the weight of the drum is reduced, heat treatment is made possible, caustic embrittlement is reduced to a minimum, the concentration of stress in the riveted zone is eliminated and, interior and exterior surfaces being smooth, the maintenance of clean boiler inside and the easier application of lagging outside is made possible.

Mr. Gross described a series of classical experiments carried out in this country and abroad, as a result of which, in the course of years, a code of practice emerged and the so-called Class I welded pressure vessel. This is a mild steel welded vessel, which complies as far as its design and manufacture is concerned with rules set out in this country by Lloyd's Register of Shipping or the Associated Offices Technical Committee.

A Class I vessel is heat treated after its completion and the welded seams, on both the outside and the inside surface, are machined to be level with the plate. Weld quality is determined by a number of mechanical tests and there is also a radiographic examination of the main welds. Similar codes of practice have been evolved in the U.S.A. by the A.S.M.E. and the A.S.M.E. in conjunction with the A.P.I.

In discussing the present well-established design practice and the factor of safety in pressure vessels, the lecturer said that in order to ensure a more rational design, and that the optimum use is made of the material, research into the relation between operating loads and stresses and ultimate strength of welded pressure vessels was necessary.

Mr. Gross quoted a few instances in which the application of mathematical analysis had given valuable results, but stressed the need for determining by experiment the behaviour of welded pressure vessels under load, not only over the elastic range, but also after yielding has occurred, ending with failure of the vessels.

Describing investigations on full scale vessels under operating conditions—or under conditions causing, by other means, stresses similar to those induced by the real loads—the lecturer stressed the services rendered by the electric resistance strain gauge which were quite out of proportion to its size, which is that of a postage stamp, or to its construction, which is simply a thin piece of wire, a piece of paper and a few drops of adhesive.

A number of slides were shown, illustrating various instances of stress-analysing full scale vessels. The most comprehensive investigation of this kind has been carried out in this country by Babcock and Wilcox, Ltd., for the British Welding Research Association. This work is now in its final stage and when concluded will provide a clear picture of the distribution of stress in a welded vessel under internal static pressure.

Strain measurements were taken by means of electric resistance strain gauges at relevant points on the external and internal surfaces of the vessel. A comparison was made between the theoretical calculation and the practical measurement of stresses in drumhead, in a shell of slightly non-circular form, and around manholes, nozzles and tube holes.

Stress Conditions

This investigation provides for the first time information on stress conditions in parts of pressure vessels inaccessible for measurement up till now, and it will greatly help in the design of future pressure vessels. Based on this detailed analysis of stresses in one common type of vessel, it is possible to see in what direction the efforts of research workers in welded pressure vessels should be concentrated.

As expected, the investigation carried out by Babcock and Wilcox, Ltd., showed that the positions where stress peaks occur in pressure vessels are around branches, manholes and other fitments. The appropriate committee of the British Welding Research

Association has decided that the investigation of these weakest points of the welded pressure vessel is the outstanding problem to which priority should be given.

This investigation will be carried out on specially constructed full-scale vessels from which all complicating features are eliminated so that the stress conditions in and around typical branch connections can be studied singly. Various methods of reinforcement will be tested under static and fluctuating pressures at the research station at Abington.

Mr. Gross described various constructions of vessels for very high pressures for the chemical industry. The American multilayer type was mentioned, which consists of a welded core tube on which successive layers of thin sheets are wrapped and welded longitudinally, wall-thicknesses up to 8 in. having been thus produced. In this country, I.C.I., Ltd., had developed a laminar type of pressure vessel, consisting of a thin centre tube surrounded by well fitting hoops, a portal frame taking care of the longitudinal effect of internal pressure.

Other thick vessels had been produced by winding around a thin core tube either wire or plain strip, and an improved method employed a profile strip to support the longitudinal stress in the vessel. An interesting wartime development was the so-called cemented vessel. This consisted of a number of thin welded cylindrical shells, fitting concentrically into each other, with gaps of about 3/16 in.—¼ in., which were filled with cement.

The second part of Mr. Gross's lecture dealt with problems of pipe line design, which, he said, were no less complex than those encountered in large diameter vessels. Industrial pipe systems convey fluids which may be at high pressure and temperature. In some modern processes, pressures of 700 atmospheres and over are used and, with the recent advance in production of special steels for high temperatures, process temperatures are likely to continue to go up.

In modern steam power plants, for instance, with the tendency towards high pressures and temperatures, it has become an increasingly difficult problem to dispose of the resulting larger expansion and contraction of the pipe line.

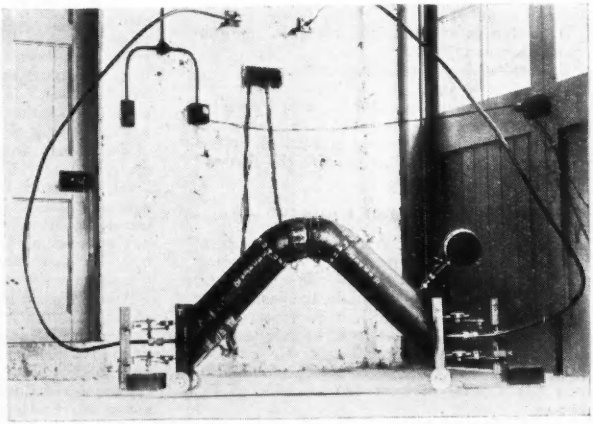
Deformation Tests

The strength and safety of a pipe line is determined by the behaviour of such parts as branch connections and pipe-bends. The curved parts of the pipe line have been the object of the attention of many engineers and mathematicians, from the day when it was discovered that the deformation of pipe-bends under external loading could be up to 400 per cent larger than was expected.

The British Welding Research Association undertook recently to carry out experiments so as to provide a comparison between welded and seamless bends subjected to internal pressure and such external forces as would be produced by changes in temperature.

In this investigation, too, the electric resistance strain gauge proved to be a more suitable instrument than any other type available before, as it made it possible to measure strain on both the outside and the inside surface of the pipe bend.

Experiments on pipe bends were still in progress, concluded Mr. Gross, but data had been already obtained from which valuable conclusions could be drawn on the relative strength of welded and seamless pipe bends.



The test arrangement for an experiment simulating conditions in service when expansion of the pipe body is caused by an increase in temperature. These experiments on pipe bends are carried out under Prof. J. F. Baker at the Cambridge University Engineering Laboratory and at the research station at Abingdon of the BWRA

ISOTOPES AND NUCLIDES

Much Wider Uses Foreshadowed in 1949

From a Special Correspondent

DURING next month the new large pile at Harwell is due to come into operation. Roughly six months later the range and activity of isotopes produced here should equal those of America and the scale of their production should then be adequate for immediate industrial demands.

The Literature

In anticipation of that day, a number of lecturers and workers with isotopes have, during the autumn of 1948, urged upon chemists the real advantages to be gained by making use of these new materials. In discussing direct industrial applications, speakers have been able to supply only hints rather than to point to well-established paths. It is significant that a major text on the subject, "Radioactive Indicators," by G. Hevesy (Interscience, Publishers, N.Y., 1948) has the sub-title, "Applications in biochemistry, animal physiology and pathology."

The "Handbook of Radioactivity and Tracer Methodology" prepared by the Air Materiel Command of the U.S. Air Forces discusses in its applications section only biological and medical ones.

Confirming this general picture, Dr. Seligman, of the Harwell Establishment, has quoted the results of a recent survey of publications as showing 2000 papers on medical and biochemical but only 12 on industrial uses.

For industrial chemists, the question of use of radioisotopes can probably best be discussed under the following heads:—

1. Value as an industrial research and production control tool.
2. Availability (including cost).
3. Safety in use.

On all of these questions—except possibly long-term costs—relatively unambiguous guidance has already been published, and a friendly offer of consultation with the Harwell staffs still holds good.

Terms and Units

It is now being urged that the term "nuclide"—originated by T. P. Kohman (*Amer. J. Physics*, 1947, *15*, 356) should be used to designate an "atomic species." The term "isotope" would then be reserved for its original meaning of an atomic species occupying a particular place in the periodic table. Thus, there are three isotopes of hydrogen but a total of over 700 nuclides so far known.

It would seem to be advisable to look for definitions of "specific activity" in its accompanying text. Thus, Paneth has defined it as the number of disintegrations per second per gram of tracer substance. Emeléus, however, in his OCCA lectures defined it as the proportion of active atoms present $\frac{A}{A + A^1}$ (when A is the number of active and A^1 the number of inactive atoms).

Named after the great pioneer workers, the curie is the unit of radiation and represents α activity equivalent to 1 gm. of pure radium or 3.7×10^{10} particles per second. This is a large unit and those more usually called for are the milli- and micro-curie.

At the 1947 International Congress of Chemistry a small international gathering of leading workers in radioactivity recommended the setting up of a new committee on radioactive standards (*Nature*, 160, December 6, 1947, p. 778). Any such body would be conspicuously incomplete did it not include representatives of the International Unions of Chemistry and Physics.

Value of Nuclides

Among the many scientific and industrial uses shown in 1948 to have immediate possibilities are the following:

Radioisotopes (nuclides) may be industrially applied.

(a) for the use of their ionising power or the penetrating power of the radiations

(b) as tagged atoms.

Ionising power may be used to dissipate static electricity and so prevent explosion risks. In the U.S.A., Po^{210} (half-life half a year) has been used, and at Harwell it is hoped soon to have β emitters available for this purpose. It has been found possible to stabilise sparks but not to reduce spark voltage, using this ionising power.

By using floats coated with an active material and riding in a vertical tube, liquid level indicators have been devised calibrated against ionisation current. These are usable with inflammable liquids.

Thickness of films, for instance, of plastic, may be continuously checked by the use of C^{14} on one side and a detector on the other.

Apart from those of the elements of lower atomic number (notably hydrogen H^1, deuterium H^2 and tritium H^3), isotopes have virtually identical properties. Thus, as is now widely known, they may be used as tracers for following the route of particular atoms in reactions or even in diffusion.

Used in this way, the great advantage of radioactive isotopes is the very low limit of detection. Thus P^{32} is detectable down to 3×10^{-15} g., roughly a hundred-millionfold increase in sensitivity over pure chemical methods.

A general discussion of methods of determination of radioactive and stable isotopes (nuclides) was held early this year by the Physical Methods Group of the Society of Public Analysts and other Analytical Chemists. (*Nature*, 161, 693.)

Among the non-biochemical applications of tracers quoted are very accurate determinations of the actual solubility of "insoluble" substances and of the volatility of the "non volatile." Metal transfer in bearings, or abrasion of metal into lubricants has been studied by the use of active nuclides.

Self-diffusion of metals can be studied by applying an active surface layer followed by sectioning and tracing the extent of penetration by autographic methods.

Obviously a matter of great industrial importance, investigations into the source of sulphur in iron have been aided by tagging the sulphur in the coal and the ore.

Thus, the types of question which one may hope to be able to answer by the use of these tools have been indicated, but few questions have yet been posed.

Preparation and Availability

In all cases, certain practical issues have been raised in such discussions during the year. What activity and half life are obtainable with the desired element? Is there time enough to synthasise it into the desired compound? What is the permissible dilution? Clearly, these are questions for consultation between the physicist producing the tracer, the chemist who has to isolate it and the intending user.

Reviews of methods of preparation of radioactive tracers have been given by Prof. F. A. Paneth, F.R.S. (*Quarterly Reviews*, Vol. II, No. 2, 1948), and by Dr. Seligman during the course of a lecture to the Society of Chemical Industry. Four stages in preparation, given by Prof. Paneth, are:

1. Selection of a suitable tracer substance.
2. Production of the chosen radioactive atoms.
3. Analytical separation and concentration of those atoms.
4. Synthesis of the tracer substance incorporating the active atoms.

The radioactive nuclides which seem to be most useful as tracers have been tabulated by Prof. Paneth in the form shown at the foot of this page.

These may be prepared by bombardment of stable atoms with neutrons (mainly in uranium piles), or with deuterons (mainly in cyclotrons) or from the fission of uranium in the pile. Isolation is a microchemical—or finer—procedure.

In order to overcome the problem of separating chemically identical isotopes, Dr. Seligman listed the following five methods, four of which take for their starting point elements other than the one desired:

After irradiation the immediate product may decay to the desired one by loss of 1, a β particle; 2, a proton, or 3, an α particle. A fourth method is to isolate from fission products of uranium, and the fifth is by the Szilard-Chalmers reaction. The last is molecular breakdown, following irradiation, and is an automatic separation and concentration process of the active nuclide.

From P.O. Box E, Oak Ridge, Tennessee, U.S.A., may be obtained "Radio-isotopes for International Distribution" (1947) giving full information on availability and costs from American sources. In Britain, the recently-formed Isotopes Allocation Com-

Element	Isotope	Half-life	Element	Isotope	Half-life	Element	Isotope	Half-life
1	^{3}H	31y.	30	^{69}Zw	250d.	52	^{129}Te	32d.
6	^{14}C	20.5m.	—	^{69}Zw	13.8h.	53	^{131}I	8d.
—	^{14}C	5100y.	33	^{74}As	16d.	54	^{135}Xe	9.4h.
9	^{18}F	2h.	—	^{76}As	26.8h.	55	^{137}Cs	33y.
11	^{22}Na	3.0y.	—	^{77}As	40h.	56	^{131}Ba	12d.
—	^{24}Na	14.8h.	34	^{75}Se	125d.	57	^{140}La	40h.
14	^{31}Si	170m.	35	^{82}Br	34h.	58	^{141}Ce	30d.
15	^{32}P	14.3d.	36	^{85}Kr	4.5h.	59	^{142}Pr	19.3d.
16	^{35}S	87.1d.	37	^{86}Rb	19.5d.	63	^{154}Eu	5-8y.
17	^{36}Cl	$10^{5}y.$	38	^{89}Sr	55d.	73	^{182}Ta	97d.
—	^{38}Cl	37m.	39	^{90}Y	65h.	74	^{185}W	77d.
18	^{37}A	34d.	40	^{95}Zr	63d.	75	^{186}Re	90h.
19	^{42}K	12.4h.	41	^{95}Nb	36d.	77	^{192}Ir	70d.
20	^{45}Ca	180d.	42	^{99}Mo	67h.	79	^{198}Au	2.7d.
21	^{46}Sc	85d.	43	^{99}Tc	$10^{5}y.$	—	^{199}Au	3.3d.
22	^{51}Ti	72d.	44	^{103}Ru	42d.	80	^{197}Hg	64h.
24	^{51}Cr	26.5d.	—	^{106}Ru	1y.	—	^{203}Hg	51.5d.
25	^{54}Mn	310d.	46	^{103}Pd	17d.	81	^{204}Tl	3.5y.
26	^{55}Fe	4y.	47	^{110}Ag	225d.	83	^{210}Bi	5d.
—	^{59}Fe	44d.	—	^{111}Ag	7.5d.	84	^{210}Po	140d.
27	^{60}Co	5.3y.	49	^{114}In	48d.	85	^{211}At	7.5h.
28	^{59}Ni	15y.	51	^{122}Sb	2.8d.	93	^{239}Np	2.3d.
29	^{64}Cu	12.8h.	—	^{124}Sb	60d.	94	^{238}Pu	50y.
—	—	—	—	^{125}Sb	2.7y.	—	—	—

mittee under Sir John Cockcroft considers applications for isotopes.

Safety

In addition to general studies of biological effects, there have been two recent papers on safety aspects of this work. Dr. E. F. Edson pointed out that there are six major groups of protective barriers and discussed each of the following:

(a) Lay-out, design and construction of establishment.

(b) Operational routines and handling of radioactive materials.

(c) Training, education and supervision.

(d) Personal protection of the worker.

(e) Detection, measurement and control of radioactive hazards.

(f) Medical surveillance of workers.

In a symposium on "Safety in Laboratories," Mr. W. G. Marley of the Atomic Energy Research Establishment has given further useful guidance. He considered inhalation of radioactive material as constituting the major risk, since the radiation would attack the lungs.

At the same time, deposition in the body might also occur by ingestion or by skin absorption and appropriate safeguards—particularly the use of protective clothing—were necessary for these risks too. A "Film Badge Service" is now operated by the National Physical Laboratory for examination of X-ray film badges worn by all workers running risks of exposure to radiation.

Health records of all laboratories hitherto working in these fields are quite clean. It is evident that the assertions that there need be no greater risk in such work than in any other laboratory work have been well substantiated.

Training and Equipment

Researchers interested in these new materials will naturally want to know how and where they can receive training in their manipulation.

Last week-end it was announced that the first two foreign scientists—an Englishman and an Indian—were accepted at Oak Ridge (Tennessee) Institute "to receive research training in radio-isotopes and other aspects of atomic energy." Dr. Seligman stated last month that Professor Paneth would be running courses at Durham during the coming spring.

Basic equipment necessary for detection and counting is estimated to cost not more than £300—a figure confirmed by contributors to discussions on this subject.

The Prospects

With the new supplies of radioactive material to be expected from the new pile, it is evident that active materials, detecting equipment and training facilities are all available. What is now chiefly needed is the enterprise to use them.

An Active Year for the Textile Institute

THE flourishing state of the Textile Institute is indicated by the membership which at the end of 1948 was 4300—two-and-a-half times the pre-war figure. New members during the year numbered 711, almost a third of whom are under 25 years of age, and many drawn from overseas.

With the election of 24 new Fellows and 61 new Associates, the number of Fellows and Associates in membership exceeds 1000 for the first time.

The annual conference was held at Buxton in May when 10 students were guests of the institute. The subject of discussion was "The Organisation of the Textile Industry" which covered a variety of subjects, including trade unions and research, and public relations and production. The conference was opened by the President of the Board of Trade, Mr. Harold Wilson, and attended by visitors from America, France, Holland, India, Norway, and Switzerland.

The bi-centenary of the invention of the carding-engine was celebrated in December by a one-day conference on carding.

The institute's annual examinations had a record entry of 114, while in the annual design competitions a feature was the number of women entrants who took 10 of the 43 prizes, including first and second places.

Widespread interest was shown in the publication of the institute's proposals for a universal yarn count system, which were approved in principle by the International Standards Organisation meeting at Buxton in June.

A number of useful publications included a list of terms and definitions, new handbooks of textile technology, and the institute's first year book.

The number of sections and branches in the British Isles was increased to 13 by the establishment of a new branch of the Lancashire section at Burnley.

£2 Million for Gas Plant.—Newton, Chambers and Company have received sufficient orders for gas plant to keep the works occupied for three years. The biggest order has been placed by the Sheffield and District Gas Company, as part of a scheme of extensions estimated to cost £2 million.

Legislation and Industry

Some Far-Reaching Changes in 1948

Reviewed by a barrister

THE year just ended is likely to be remembered as one more productive of legislative proposals or changes bearing directly upon the chemical and metallurgical industries than was any of its predecessors. Several Acts of Parliament which come within that category have received the Royal assent during 1948, the number of Statutory Instruments having the force of law has not noticeably diminished and there have been several decisions in the courts which have important effects upon the responsibility of employers in chemical, metal and associated industries for the safeguarding of workpeople.

Control of Monopolies

The Monopolies and Restrictive Practices (Inquiry and Control) Act contains provisions which could have a very wide effect on the whole field of industry, if they are used to the full. It is the first attempt at the type of "trust busting" legislation which is common in the United States.

A Monopolies and Restrictive Practices Commission is to be established, to operate in association with the Board of Trade. The board may refer matter to the commission for report where at least one third of a particular type of commodity is supplied or processed or exported in, or from, the United Kingdom, or a substantial part thereof, either

(1) by one person, or
(2) by interconnected companies, or
(3) by two or more persons who "whether voluntarily or not and whether by agreement or not, so conduct their respective affairs as in any way to prevent or restrict competition."

The Act also applies where by agreement a class of goods is withheld from the United Kingdom or a substantial part of the country.

The commission may be required to report whether the Act applies in a particular case and on what grounds, or it may be asked to go further and say whether the conditions operate against the public interest and why. The commission must answer the questions referred to it by the board, must give its reasons and publish a report.

The public interest is defined to include

"(a) the production, treatment and distribution by the most efficient and economical measures of goods of such types and qualities in such volume and at such prices as will best meet the requirements of home and overseas markets.

"(b) The organisation of industry and trade in such a way that their efficiency is progressively increased and new enterprise encouraged.

"(c) The fullest use and best distribution of men, material and industrial capacity in the U.K.

"(d) The development of technical improvement and the expansion of existing markets and opening up of new markets."

If the commission reports that conditions operate, or may be expected to operate, against the public interest, or if, at least three months after the report, a resolution to that effect is carried by the House of Commons, then a competent authority, in order to remedy the mischief may,

(a) declare agreements unlawful,
(b) require parties to determine agreements,
(c) declare it to be unlawful to withhold supplies either absolutely or conditionally,
(d) declare preference as to the provision of supplies or services to be unlawful,
(e) declare conditional sales of a certain type unlawful.

For this purpose the Board of Trade, Ministry of Supply, Ministry of Works, Ministry of Fuel and Power, Ministry of Health, Ministry of Agriculture, Ministry of Food, the Admiralty and the Secretary of State are competent authorities.

No criminal proceedings will lie for the breach of such an order; but it will be enforced in the civil courts.

Encouraging Inventions

A new Act, founded upon the Development of Inventions Bill, presented in May, establishes a National Research Development Corporation, which will be fathered by the Board of Trade. Its function will be to develop and exploit inventions resulting from public research; it may also exploit private inventions if it appears that these are not being otherwise sufficiently developed. It may acquire, hold and dispose of rights in connection with these inventions; it may grant rights either gratuitously or for a consideration.

The Act provides the corporation with funds to begin its work. But it does not give it compulsory powers. It will therefore be able to deal with inventions only where

the owner is prepared to agree. It will not be able to deal with inventions only where of inventions.

No private body may now initiate a public gas supply. It is the responsibility of the Area Gas Board to meet all demands for the supply of gas, that can economically be met, to provide a supply of coke, other than metallurgical coke, and to supply by-products. It also has power to sell, hire and supply gas fittings and to manufacture plant and gas fittings and coke fittings, except for export.

Radioactive Substances

The Radioactive Substances Act establishes a State monopoly in the production of substances containing any radioactive chemical element, whether natural or artificial. This applies to any substance, solid or liquid, gas or vapour. The Minister of Supply is given power to manufacture, produce, buy, treat, store and dispose of any radioactive substance. He may control by order the import and export of these substances.

The sale and supply is restricted to medical and dental practitioners, pharmacists supplying on their prescription and persons licensed by the Minister. There is a similar control of irradiating apparatus. The Minister is given power to make safety regulations for occupations involving radioactive substances and irradiating apparatus.

Commercial grade sodium and potassium bichromate in bulk quantities are freed from price control (Statutory Instrument No. 752).

The maximum prices of ground sulphur (No. 751) and sulphuric acid (No. 294) have been increased. Transport costs have led to an increase in the price of certain fertilisers —sulphate of ammonia, muriate of potash and sulphate of potash.

The prices fixed for molasses and industrial alcohol have been altered. The cost of acetone is reduced, molasses supplied as cattle feed remains the same and all other types are increased. Doubly rectified alcohol (SVR) is controlled for the first time. The reduction in price where delivery is made in buyer's packages or direct from the control depot is increased (No. 584).

An increase in the maximum price of zinc and zinc products early in the year (No. 121) was followed by further increases and also increases for copper and lead (No. 2201).

Iron and Steel Supply

Early in the year constructional steelwork was removed from control. Maximum prices were increased. The authorisation procedure was also revised, but the changes are no longer of importance as later all but a few M forms were cancelled. (Nos. 81 and 606.)

Later prices were increased for pig iron (other than common foundry iron) and semi-finished steel (No. 1289).

Steel castings, malleable tube fittings and gas list wrought fittings may now be acquired without licence for use in the U.K. Conduit fittings are excluded from control as iron and steel. The use of tinplate and backplate or sheet for advertising signs is prohibited, except under licence (No. 1333).

The maximum prices for silico-manganese bars, rods and wire are also increased; an increased allowance is made for heat treatment of alloy and light steel. (No. 1913.)

The courts do not make law, they confine themselves to declaring what the law is. Constitutional law draws a clear distinction. But to the practical man a declaration on a point which is in doubt seems just as important as a section of a new Act.

During the year the courts have given some most interesting decisions on industrial law, throwing light on points which have been much disputed.

Ruling on Fencing

The House of Lords made an authoritative pronouncement on the purpose of fencing. Lord Porter expresssed it thus: "Fencing, in my opinion, means the erection of a barricade to prevent any employee from making contact with the machine; not an enclosure to prevent machinery from flying out."

The accident which gave rise to the ruling was a highly unusual one. A machinist in a boiler shop was standing operating his lathe, immediately in front of which, and quite near, was the motor driving the main shaft of the shop; the shaft was situated over the motor at a height of about 25 ft. and was operated by a belt from the motor. The motor, belt, shaft and pulley, therefore, formed part of the transmission machinery which is required to be fenced by the Factories Act.

In accordance with usual practice, they were fenced to a height of about 8 ft., which was sufficient to prevent any operative coming into contact with them. One day the belt broke, lashed out over the fence and struck and injured the machinist working his lathe.

Acting on the above principle the House of Lords refused to award damages against the employer, because it found as a fact that the employer had securely fenced that part of the transmission machinery on which a workman could enter and that the belt was in such a position to be as safe as it would be if securely fenced, unless it broke.[2]

The wide application of this duty is brought out by a comparison of two recent

cases. In the first[2] an inspector claimed damages for serious injury to the hand, inflicted by a press operated by an electric motor and provided with a secure guard for all its normal operations.

The guard had been lifted while the dies in the machine were altered by a tool maker and set in the press by a tool setter. Samples were produced and rejected by the inspector. After a discussion as to whether the machine was working properly, the inspector and a charge hand looked underneath. The inspector was pointing to a suspected defect, when the tool maker put his foot on the starting pedal. The press came down on the inspector's fingers.

Failure to Fence

The inspector based his claim to damages on the failure of the employer to fence the machine in accordance with the Act. The employer claimed that this fell under the exception in Section 16 of the Factories Act, that there was no duty to fence "when any such parts are necessarily exposed for examination and for any lubrication or adjustment shown by such examination to be immediately necessary."

The Court of Appeal construed these words strictly and decided that the tool setting operation was not examination, lubrication or adjustment. Therefore the employers were in breach of their duty and liable in damages.

The second case[3] was a prosecution under Section 14 (1) of the Act which provides :—" every dangerous part of any machinery shall be securely fenced unless it is in such a position as to be as safe to every person employed or working on the premises as it would be if securely fenced."

The LMS Railway was charged with failing to fence securely the long travel gear wheels of an overhead gantry crane in a boiler shop. The crane in question travelled on tracks on a wall which ran the length of the boiler shop. The lifting tackle was suspended from a cross carriage. The crane was normally driven by an electric motor on a platform 17ft. 6 in. above floor level, on which were two large gear wheels. A power breakdown occurred when it was urgently necessary to unload some trucks. As an emergency measure, for the first time in 28 years, it was decided to manipulate the cross carriage manually. In the course of this operation a workman was badly injured by the gear wheels.

The Sheriff acquitted the railway company, holding that in view of the entirely exceptional circumstances, the gear wheels were, despite the accident, so positioned as to be as safe to every person employed or working on the premises as they would be if securely fenced.

A distinction can be drawn between the first case, in which there was merely a difficulty in tool setting, and the second, in which it was probable that the operation would never take place again.

A Court of Appeal decision[4] of some importance laid it down that there is a common law duty on an employer to take such steps for the elimination of, or protection from, noxious dust as are necessary for safety. A workman died of pneumoconiosis caused by dust from a grinder near which he worked.

The grinder was used by various workmen to sharpen their tools; it was almost continuously in use, but the Grinding of Metals (Miscellaneous Industries) Regulations did not apply, because no one person was wholly or mainly employed in sharpening tools.

The employer contended that, as the regulations did not apply, he was not liable. The court rejected this and based its decision on the duty at common law to provide an employee with a safe system of work.

It said that the regulations were a warning to the employer that it was dangerous for a workman to be in constant proximity to an unprotected grinder; in such circumstances the employer should protect the workman, even though the regulations do not require him to do so.

REFERENCES

[1] *All England Reports*, 1948, 2, 386 : Carroll *v.* Andrew Barclay, Ltd.
[2] *All England Reports*, *1*, 363 : Nash *v.* High Duty Alloys.
[3] *Scottish Law Times*, 1947, 67 : H.M. Inspector *v* L.M.S. Rly.
[4] *All England Reports*, 1948, *1*, 353 : Frankin *v.* Gramophone Co.

Technical Publications

Colours, Varnishes, Painting Materials (*Farben, Lacke, Anstrichstoffe*), a monthly journal by Wissenschaftliche Verlagsgesellschaft m.bH., Stuttgart, Tübinger Str. 53, has resumed publication. In addition to its scientific, industrial and commercial news, each number contains a supplement, called " leaflets for the rising generation," dealing with general chemical and physical fundamental knowledge.

* * *

The 1949 edition of the Association of British Chemical Manufacturers' directory, " British Chemicals and their Manufacturers," which replaces the 1946 edition, has just been published. It includes current information regarding the manufacturers in this country of all types of chemicals, *e.g.*, heavy, fine, pure, coal tar, dyestuffs, etc. A copy of this publication is sent free of charge to inquirers writing to the Association's offices, 166 Piccadilly, London, W.1, giving indication that they are commercially interested in the materials concerned.

Protection of Chemical Inventions

by JAMES G. FIFE, M.Sc., Ph.D., F.R.I.C.

The author

CHEMICAL inventions, like other inventions, are protected in this country by the grant of Letters Patent, and such a grant may be regarded as a bargain between the inventor and the Crown whereby, in return for a monopoly for a limited period of years granted by the Crown, the inventor describes in the Complete Specification of his Letters Patent the manner in which his invention may be carried into effect.

After the Letters Patent have expired the public is put into possession of the invention and is able to manufacture the substance or carry out the process of the invention without having to undertake any further research. The limited period is 16 years from the date of filing of the complete specification, provided that the necessary renewal fees are paid and provided that the patent is not revoked either by the comptroller or the High Court on any of the grounds provided by law.

The Specification

The grant of Letters Patent in this country is at present regulated by the provisions of the Patents and Designs Acts, 1907 to 1946, and this is in effect a consolidated Act, which consists of the original Act of 1907 with numerous amendments up to 1946.

The complete specification may be regarded as consisting of two portions: a descriptive portion and the claims. The function of the claims is to delimit clearly the ambit of the monopoly claimed and not to state the advantages of the invention.

[This paper was presented before the first joint meeting of the London & South-Eastern Counties Section of the Royal Institute of Chemistry, and the London Section of the Society of Chemical Industry.]

In this connection, perhaps, I may mention the story of the inventor who is reputed to have described his invention and then inserted the prescribed preamble to the claims reading: "Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is . . ." followed by the words "one thousand pounds."

In order to obtain protection for his invention, the inventor must make an application to the comptroller at the Patent Office, the application being accompanied by either a provisional specification or a complete specification.

Temporary Protection

The possibility of filing a provisional specification is very advantageous, particularly if the invention is in the early stages of its development. The usual course is to file a provisional specification which does not contain claims and need only state the nature of the invention.

But, in view of the fact that the provisional specification is the foundation for the subsequent complete specification, it is advisable to make the provisional specification as full as possible in order to provide an adequate foundation for the complete specification and avoid any possibility of the Patent Office examiner ultimately raising the objection of disconformity between the provisional and the complete specifications.

This objection can arise if the invention claimed in the complete specification is not the same as the invention set forth in the provisional specification. If such an objection is upheld it may have very serious consequences, because the application will be post-dated to the date of the filing of the complete specification and the inventor may have made his invention available to the public in the interim.

The Risk

Thus his patent may be invalid, owing to publication in the interim between the filing of the provisional and complete specifications, even though the publication has emanated from the inventor himself.

After the complete specification has been filed, it is examined by an examiner at the Patent Office who is an officer with technical qualifications. The examiners in the Patent Office are divided into groups who deal with particular classes of inventions so that in

general a chemical case will be dealt with by an examiner who has chemical qualifications and experience.

The examiner makes a search in British patent specifications published within fifty years before the date of the application, and if he considers that the complete specification claims an invention which has already been published in a specification revealed by his search, he will cite the specification as an anticipation and it will be necessary for the applicant to convince the examiner that his claims are distinguished from the disclosure of the cited specification.

Likewise, the examiner will make a search to see if there are any earlier applications which conflict with the application under examination even if these applications were not published before the date of the application under examination but are merely of earlier date. Again, it is necessary for the applicant to distinguish his inventon from these prior applications, which are usually known as prior grants.

Prior Claims

The examiner cannot, however, press a prior application which is not a prior publication until a patent has actually been granted thereon. The examiner also examines the complete specification to see that it is clear and in conformity with the provisional specification and also in order to see that the invention is adequately described in the complete specification.

The examiner may also raise a number of other objections, which it is not necessary for me to discuss at the present time. The examiner is also entitled to cite any other document which was published in the United Kingdom before the date of the application, if he considers that the disclosure of the prior document anticipates the claims of the application, but in practice he does not make a comprehensive search as in the U.S.A., Holland and certain other countries, but merely brings to the applicant's notice any other prior publications of which he may be aware.

Prior to the war the staff of the Patent Office was endeavouring to place this further search on a more systematic basis, but in view of the war and post-war circumstances it has not been possible for this improvement in the search to be carried out.

After the examiner's objections have been dealt with to his satisfaction, the application is accepted and the acceptance is advertised in the *Official Journal* (*Patents*) and the specification is printed, but the application remains open for opposition by any interested party for a period of two months after the acceptance of the application. Opposition may be based on certain specified grounds, the principal ones being prior publication, prior grant and insufficient or unfair description.

DR. J. G. FIFE, the author of this paper, is a graduate of University College, London. He was awarded his B.Sc. degree—with second class honours in chemistry—in 1924, *and received his M.Sc. in* 1937 *for his thesis on "Studies in Analysis by Internal Electrolysis," the research for which was carried out at the Sir John Cass Technical Institute, London. For a further thesis on the same subject Dr. Fife was given the degree of Ph.D. in* 1941. *He became a fellow of the Chartered Institute of Patent Agents in* 1935, *and an Associate* (1926) *and Fellow* (1937) *of the Royal Institute of Chemistry*

It is important to note that the opponent may not rely upon what is known as "lack of subject-matter"; that is to say, that there is no invention disclosed in the applicant's claims as compared with the prior art. Also, the ground of lack of utility is not open to an opponent; that is to say, an opponent is not allowed to allege that the process described will not work in practice or that the invention includes inoperative embodiments.

Care must be taken to distinguish between commercial utility and patent utility because a process which might be quite impracticable from a commercial point of view, *e.g.*, owing to high cost, might possess patent utility in the sense that it gave the promised result.

After the expiry of the opposition period or after the opposition proceedings, if such are determined in favour of the applicant, a patent is sealed upon the application, upon payment of the sealing fee.

It should be mentioned at this point that if the applicant and the examiner are not able to come to agreement, then they are heard by the comptroller or one of his deputies who gives a decision, and if the applicant is not satisfied with this decision he may appeal to the Patents Appeal Tribunal, which consists of a Judge of the High Court, whose decision is final.

Likewise, in opposition proceedings, the steps to be taken are laid down under the Patent Rules. Briefly, a statement is filed by the opponent, a counter-statement by the applicant, evidence, if desired, is given by each party by way of declaration and the parties are then heard by the comptroller or one of his deputies, who gives a decision,

which again is subject to an appeal to the Patents Appeal Tribunal, where the decision is final.

The foregoing is a sketch, necessarily a very brief one, of the steps which are taken in order to obtain Letters Patent, and I have given it to assist those who are not acquainted with the procedure to understand the somewhat technical terms which I must necessarily use.

I propose to consider the problems which arise in protecting chemical inventions and which do not arise in protecting other inventions or, at any rate, not to such a large extent. One of the chief problems in protecting a chemical invention is that very often the invention consists in the appreciation that a previously unknown compound has certain valuable properties.

Chemical Restrictions

In some cases it may be that the inventor desires to produce a compound with particular properties, and by his knowledge and experience he is able to forecast the structure of compounds which are likely to possess the desired properties, whereafter it merely becomes a matter of synthesising the compounds and testing them.

In some cases, of course, the synthesis will be a very difficult matter, but in other cases, once the desired structure has been arrived at, the synthesis may be of a simple nature. The inventor then, however, finds himself in a difficulty in that Section 38A of the Patents Act prohibits the claiming of a chemical compound as such, even if the compound is novel and restricts the inventor to claims to the substance when prepared or produced by the methods of manufacture particularly described and ascertained, or by their obvious chemical equivalents.

Once a substance has been prepared it is very often easy to provide numerous other routes for its preparation, and if the inventor is then to protect his real invention adequately he may find that he has to file a number of patent applications; and even then cannot be sure that he is obtaining complete protection because some other party may find a process for the manufacture of the substance which falls outside the claims of any of his patents.

It is true that presumably some protection is intended to be given to the inventor by the term "obvious chemical equivalents," but it is very doubtful as to how this term gives any real extension of the protection. In view of the fact that there is no decided case on this point the meaning of the term must at present be regarded as uncertain.

The inventor is also faced with another serious problem, namely, that he may have devised a process that results in the production of a particular compound but he is uncertain as to whether the same process will work with related initial materials to produce compounds similar to the one which he has discovered.

Thus, for example, he may have devised a process commencing with a methyl compound, and he may be fairly sure that the process will work with the next higher homologue or even with several of the higher homologues, but usually a point will arise at which he will be uncertain as to whether or not the process will still work.

Sometimes it may be possible to overcome the difficulty by testing the process with a judicious selection of initial materials whereby the inventor may be able to arrive at some decision which is fairly certain to be correct. Obviously, the inventor will not desire to confine himself to one compound, if it is at all possible to avoid such a limitation, because he may merely be pointing out a way to others whereby they may produce similar compounds with similar properties while remaining outside the claims of his patent.

This is, in my opinion, one of the most difficult problems in patent law, and particularly in chemical cases. In other words, the problem is to claim the invention sufficiently widely to include the operations of all likely infringers within the term of the patent, but at the same time not to claim the invention so widely that it is invalid for any reason. The grounds upon which a patent may be invalid are set forth in Section 25 of the Patents Act, and when it is borne in mind that there are no less than 16 grounds upon which a patent may be held to be invalid, it will be realised that the inventor's task is not an easy one.

Framing the Claim

In my opinion, if it is a question of choosing a somewhat wider or a somewhat narrower claim, in general it is better to choose the somewhat narrower claim since, although some potential infringers may escape, the patent will probably have a much better chance of being upheld if it is ever attacked.

The problem which I have discussed is a particularly acute one in the pharmaceutical field, when very often the real invention lies in appreciating the valuable properties of a particular compound or compounds, and the whole merit of the invention depends upon these properties. I refer in particular to cases in which the process claimed for the synthesis of the compound is a process which is well known in itself for a similar compound, so that clearly the patent must be devoid of subject matter; that is to say, it is lacking in invention, unless the promised properties are, in fact,

possessed by all the compounds included within the patent

To illustrate the difficulties which arise, I would refer to two well known cases, the first of which is that of Sharp & Dohme, Inc., v. Boots Pure Drug Co., Ltd.,[1] which was decided in 1927. In this case the patent related to the manufacture of new alkyl resorcinols. Claim 1 of the specification[2] read as follows :—

"The method of making akyl resorcinols containing more than 2 carbon atoms in the alkyl group (except *n*-propyl and *n*-butyl) which comprises heating together resorcinol, a fatty acid containing more than 2 carbon atoms (excepting propionic and *n*-butyric acid) and a condensing agent such as zinc chloride, until reaction takes place, and subjecting the resulting intermediate ketone to the action of a reducing agent such as zinc amalgam and hydrocloric acid."

It will be seen that the process consisted of two stages, in the first of which resorcinol was condensed with the appropriate fatty acid by heating with a condensing agent such as zinc chloride, and the second of which consisted in reducing the ketone produced with a reducing agent such as zinc amalgam and hydrochloric acid. Both these reactions were known and, in fact, had already been applied to the production of methyl, ethyl, *n*-propyl and *n*-butyl resorcinols, and this, of course, was the reason for the excluding note "except *n*-propyl and *n*-butyl."

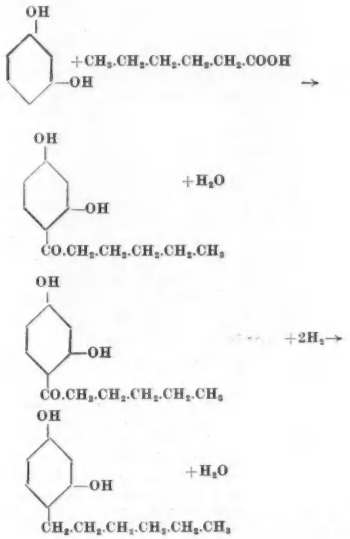
A Known Reaction

In this case the patentees were, in fact, stating in effect that they had made the discovery that the process which was already known for the methyl, ethyl, *n*-propyl and *n*-butyl compounds, could be carried out for all the higher homologues, there being no upper limit as to the size of the alkyl group. Stated in this way, it is clear that there could be no invention because, although it may be unexpected that the reaction would proceed with certain of the compounds, it clearly could not be an invention to claim a known reaction for all the compounds of the series not specifically described.

The patentees, in fact, described specifically the manufacture of isobutyl resorcinol, isoamyl resorcinol, normal amyl resorcinol and normal hexyl resorcinol. The discovery upon which the invention was really based was that normal hexyl resorcinol had a much higher Rideal-Walker co-efficient than the lower homologues, as is shown by the following table :—

Substance	Rideal-Walker coefficient
Isobutyl resorcinol	18
Isoamyl resorcinol	22
Normal amyl resorcinol	21
Normal hexyl resorcinol	50

The reaction scheme may be illustrated for the case of normal hexyl resorcinol as follows :—



and if the patent had been limited to the preparation of normal hexyl resorcinol with a clear statement as to the remarkable properties of that substance, it may well be that there would have been some prospect of the patent being held valid. In my opinion the patentees sealed the fate of the patent by attempting to claim far too much.

Perhaps they shrank from limiting the invention to normal hexyl resorcinol, in case some other party found later that one of the higher resorcinols was better, or at any rate as good, but this case is a good illustration of the danger of making the claims of the patent too wide. The result of the action was that the patent was held invalid, and this judgment was confirmed on appeal.

A recent case which illustrates the same point, and which has been much discussed, is the application by Boots Pure Drug Co., Ltd., for the revocation of Letters Patent No. 533495 granted to May & Baker, Ltd., and Ciba, Ltd.[3] In this case the invention was based upon the discovery of the remarkable therapeutic property of sulphathiazole, and had the patentees been content to limit their claims to the protection of sulphathiazole, or possibly sulphathiazole and sulpha-methylthiazole, the patent would, in my opinion, have had a very good chance of being upheld, because the outstanding advantages of the

invention, if claimed in this limited form, could not be denied.

What, in fact, the patentees claimed in claim 1 was a manufacture of benzene-sulphonamide-thiazole derivatives, wherein a benzene sulphonic acid, containing as a nuclear substituent in the para-position an amino-group, or a substituent capable of conversion into an amino-group of the kind formerly defined, is converted, in the form of a reactive acid derivative (other than a benzene sulphonic acid halide having a free amino-group in para-position), into a benzene sulphonamide-compound containing as a substituent in the sulphonamide group the radical of a thiazole, by a method known to be capable of converting reactive acid derivatives of benzene sulphonic acids into benzene sulphonamides containing a hydrocarbon radical as a substituent in the sulphonamide-group.

Supplementary Claims

The patent contains three other process claims:

2. A manufacture of benzene-sulphonamido-thiazole derivatives by causing a benzene sulphonic acid halide or ester containing, as a nuclear substituent in the para-position, an amino-group or a substituent capable of conversion into an amino-group of the kind hereinbefore defined (other than a benzene sulphonic acid halide having a free amino-group in para-position) to react with a thiazole containing an amino-group.

3. A manufacture of benzene-sulphonamido-thiazole derivatives by causing a benzene sulphonamide containing as a nuclear substituted in the para-position an amino-group or a substituent capable of conversion into an amino-group of the kind hereinbefore defined to react with a thiazole containing a halogen atom.

4. A manufacture as claimed in any one of the preceding claims, wherein the benzene sulphonic acid derivative contains in the para-position a substituent capable of conversion into an amino-group of the kind hereinbefore defined, and the resulting product is subsequently treated to convert into an amino-group the substituent so convertible.

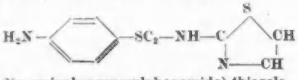
The patent also contains a product claim reading as follows:—

Benzene-sulphonamide-thiazole-derivatives whenever prepared or produced by the manufacture particularly described and ascertained herein or by any process which is an obvious chemical equivalent thereof.

The term " substituent capable of conversion into an amino group " used in claims 1 to 4 was defined in the specification as an acylamino, nitro, nitroso, azo or hydrazo group or a halogen atom.

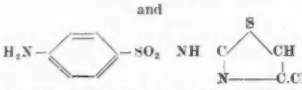
It will be seen at once that the number of substances falling within the scope of the claims is enormous, because the substituents in the two reactants could be of the most varied nature; and, even making certain assumptions of limitations, it was estimated by the petitioners in the action that the claims of the patent included the production of about 97 million compounds. This was not seriously denied by the patentees, although they considered that the number was somewhat less.

The enormous number of possible compounds will be seen at a glance from the structural formulæ of the two substances specifically described, namely:



2(*p*-aminobenzenesulphonamido)-thiazole
(sulphathiazole)

and



2(*p*-aminobenzenesulphonamido)-4-methyl-thiazole
(sulpha-methyl-thiazole)

—bearing in mind the possible substituents in the thiazole ring and in the benzene ring including the para amino group. In this connection, it may be mentioned that the specification states that the amino group " . . . may be a substituted amino group, for instance an alkylamino, N-acyl-N-alkylamino, or aralkylamino group and the benzene sulphonic acid derivative may contain still further substituents, for instance, an alkyl group."

Since the reaction for the production of the compounds was well-known, as in effect was admitted in the claims themselves, it was clear that the patent, if it were to be supported at all, must be supported on the basis of the improved properties of the products. Quite obviously the patentees could not allege that 97 million compounds or even a much lesser number of compounds could all have the remarkable therapeutic properties possessed by sulphathiazole. Only a very small proportion of the field could have been explored in practice.

The patentees therefore attempted to restrict the claims of the invention by way of amendment to sulphathiazole and sulpha-methyl-thiazole. The case was heard by Mr. Justice Jenkins and he decided that the amendments were not such as could be allowed, in view of the fact that they made the invention as claimed by amendment a different invention from the invention claimed before amendment. Consequently he refused to allow the amendments and revoked the patent, which in its unamended form was admittedly invalid.

(To be concluded)

News Summary of 1948

JANUARY

FULL agreement was announced by the Ministry of Supply on the safeguards being taken at Harwell to protect the waters of the River Thames from radioactive effluents.

A new Welsh factory for synthetic resins was started at Pontyclun, near Cardiff, by the Permutit Company.

Distribution of streptomycin in Eire was entrusted to the Medical Research Council.

By using seaweed as a raw material, development of a chemical industry in Scotland worth £15 million annually was possible, according to Sir Steven Bilsland at an exhibition "Seaweed Harvest" in Edinburgh.

In the report of the working party set up to investigate conditions in the hand-blown domestic glassware industry, it was urged that a research association should be formed, and consideration given to the establishment of a design centre.

The award of 45 Fellowships in chemistry for the 1948-49 academic year were announced by the E. I. Du Pont de Nemours Co.

Monsanto Chemicals, Ltd., announced the formation of a central engineering department to be located in London.

Amber Chemical Industries, Ltd., was incorporated as a public company to acquire the whole of the Amber Chemical Co., Ltd., and its group of chemical and allied industries.

An industrial Research Council was set up in Northern Ireland.

Total value of chemical exports (excluding drugs and dyestuffs) during the month was £3,377,975, an increase of more than £152,000 on the total for January, 1947.

Sir Henry Tizard

Prof. J. D. Cockroft

New Year Honours.—Among those on whom knighthoods were conferred were Prof. J. D. Cockcroft, director, Atomic Energy Research Establishment, Harwell, and Prof. R. V. Southwell, rector of the Imperial College of Science and Technology.

Sir Henry Tizard was installed as president of the British Association. He was also appointed chairman of the Industrial Productivity Committee, among whose members were Sir Edward Appleton (secretary, DSIR) and Sir William Stanier (scientific adviser, Ministry of Supply).

Mr. V. St. John Killery was appointed a director of Imperial Chemical Industries, Ltd.

Dr. John R. Bowman was appointed head of the newly established Department of Research in Physical Chemistry, American Mellon Institute.

Mr. R. Kingan was awarded the American Medal of Freedom with Bronze Palms, in recognition of his services in co-ordinating chemical defence research work between Britain and America as representative of the British Central Scientific Office in Washington from 1942 to October, 1945.

Sir John Anderson was re-appointed to the board of Imperial Chemical Industries, Ltd., on his resignation from the Advisory Committee on Atomic Energy on its dissolution.

Viscount Leverhulme, governor of Lever Brothers and Unilever, Ltd., was nominated an honorary member of the Chemists' Club, New York.

Dr. W. D. Scott

FEBRUARY

A U.S. report on British industries suggested that there was evidence of backwardness, technological obsolescence, and inadequate mechanisation.

In an action which lasted 17 days, Boots Pure Drug Co., Ltd., petitioned for the revocation of letters patent No. 533,495 granted to May & Baker, Ltd., and Ciba, Ltd., for an invention entitled "manufacture of new benzene sulphonamido derivatives." Mr. Justice Jenkins, in allowing the revocation, in effect rendered available to more general production an important group of benzene sulphonamido substances hitherto protected by patent rights.

A fifteen-year agreement on the production of aluminium between Jugoslavia and Hungary was reported.

Latest information on iron and steel showed rising production in Austria, Sweden and Brazil.

Brymbo Steelworks, near Wrexham, was acquired by Guest, Keen & Nettlefolds.

Their decision to suspend production of barium, ferric and ferrous chlorides and toluene nitration products and soda crystals was announced by Athole G. Allen (Stockton), Ltd., which gave as the reason the difficulties experienced in obtaining raw materials to maintain production for home and export trade.

The official report was published by H.M. Stationery Office on circumstances associated with an explosion in a steam jacketed pan at a Stratford works in June, 1947.

Annual Report No. 83 on Alkali Works, 1946, by the Chief Inspectors for England and Scotland, was published by HMSO.

The Sir George Beilby Memorial Fund awards, suspended during the war (from 1941-46 inclusive), were reinstituted and awards for 1947 were announced as follows: Dr. G. Raynor for his researches on the constitution of alloy systems; and Dr. G. Rigby for researches on refractory materials.

The Harrison Memorial prize for outstanding merit in any branch of pure, or applied, chemistry was awarded to Dr. Dereke Harold Richard Barton.

Production of sebacic acid and related compounds in the U.K. was announced by the Geigy-Hardesty Co., Ltd.

Decisions to undertake atomic research projects were reported from Australia, China, and Norway.

Total value of chemical exports (excluding drugs and dyestuffs) during the month was £3.3 million compared with £2.526 million in February, 1947.

Dr. W. D. Scott, head of the company's department of research and development, was appointed a director of Monsanto Chemicals, Ltd.

Mr. C. H. Greenewalt, succeeded Mr. Lammont du Pont, to become the tenth president of the Du Pont organisation.

MARCH

New editions of three British Standards for cement were issued covering composition, sampling procedures and tests of fineness, chemical composition, strength, setting time and soundness.

The price of lithopone was raised to £33 12s. 6d. per ton.

Coke industry workers claimed a 42-hour week.

A contract for the construction of chemical plant in the U.K. to produce stearic and oleic acids, using the Emersol process, was awarded by Lever Bros. & Unilever, Ltd., to the chemical plants division of the Blaw-Knox Company, Pittsburgh, Pa.

The existence of a potentially large chemical market in China was revealed by report of the United Kingdom Trade Mission in the autumn of 1946, published by HMSO.

The first detailed and illustrated report on the Japanese agar-agar industry was issued by BIOS.

Increased price of molasses was announced by Board of Trade.

Steel output in February achieved a new record average of 289,400 tons weekly.

The preliminary hearing began of a petition for the interdict against the North British Aluminium Company, Fort William, in which contamination by noxious fumes was alleged.

A new method for investigation of pyrolysis of high polymers was developed in the U.S.A. by S. L. Madorsky and Sidney Straus, of the National Bureau of Standards.

Chemical exports for March (excluding drugs and dyestuffs, etc.), amounted to £3,695,151, an increase of £1,268,879 over the same month in 1947.

Superphosphate produced by the British fertiliser industry in March reached a record of 103,676 tons.

Sir Arthur John Griffiths Smout was elected president of the Institute of Metals.

Mr. Robert Crooks Stanley, chairman and president of the International Nickel Company of Canada, was awarded the Institute of Metals (Platinum) Medal for 1948.

Mr. M. Laurence Merriam, managing director of BX Plastics, Ltd., was appointed by the Government as special examiner to review Board of Trade controls.

Mr. A. S. White resigned his post as group leader of the chemical engineering section of I.C.I. (dyestuffs division) on his appointment as superintendent of the chemical engineering division of the Atomic Energy Research Establishment, Harwell.

Mond Nickel Fellowships for 1947 were awarded to L. H. Walker, Reynolds Tube Co., Ltd., and D. R. G. Davies, Richard Thomas & Baldwins, Ltd.

APRIL

The Monsanto Chemical Co. stated at the annual meeting of stockholders that the Texas City plant would be fit to operate again by June. The plant, a major unit in the firm's production of styrene, was destroyed when a cargo of ammonium nitrate exploded in the city's harbour in April, 1947.

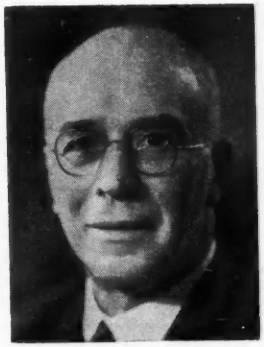
A verdict on the Texas City disaster resulting from an ammonium nitrate explosion a year ago was announced by four chemists of the U.S. Army Ordnance Department at Picatinny Arsenal, New Jersey. Their report stated that one means of rendering such outbreaks less likely was to assure a supply of fresh air in storage areas.

As a sequel to the Texas ammonium nitrate disaster, the Monsanto Chemical Company filed a $50 million claim for damages against the U.S. Government.

A revival of production of iron and steel was reported from the Soviet zone of Germany.

A deputation representing users of light hydrocarbon oils requested the Chancellor of the Exchequer to consider the abolition of the 9d. a gallon tax imposed on such oils when used entirely in manufacturing processes.

A review issued by the Polish Embassy pointed to very large recovery in the production in Poland of industrial chemicals and forecast further large expansions.



Sir Arthur Smout

Shortage of soda ash and other raw materials caused shelving of a £300,000 development scheme by Alloa Glass Work Co., Ltd.

The Midland Chemists' Committee proposed to form in Birmingham a chemical club on the lines of the existing Chemical Club in London.

Reduction in the Government target for exports of chemicals, dyes, dyestuffs, paints, and distempers, by £1.05 million was announced by the Board of Trade.

The formation of the British Bureau of Non-Ferrous Metal Statistics was announced, with offices in Birmingham.

Total value of chemical manufactures (excluding drugs and dyestuffs) was £3,862,371 as compared with £2,663,706 in April, 1947.

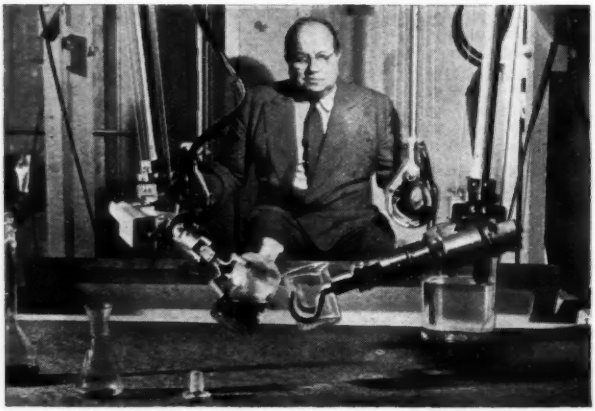
One of the principal items in the 1947 balance sheet of Ciba, Ltd., Basle, was the allocation of 12 million Swiss francs to finance research activities.

Tygan, a new plastics textile, was introduced by Fothergill & Barvey, Ltd., Manchester.

Board of Trade orders increased the price of ground sulphur and stabilised that of bichromates.

The 107th annual general meeting of the Chemical Society elected the following officers: President, Sir Ian Heilbron; treasurer, Sir Wallace Akers; hon. secretary, Dr. Alexander King. The Chalmers Medal for 1945 was awarded to Dr. E. M. Lourie.

Dr. C. E. H. Bawn was appointed to the Grant-Banner Chair of Inorganic and Physical Chemistry, Liverpool University.



Mechanical "hands" designed by Mr. J. Payne, of the Knolls Atomic Power Laboratory, were demonstrated for the first time in May by scientists of the General Electric Co. in New York. The remote-control manipulator performs delicate tasks while the operator remains protected

The Bessemer Gold Medal for 1948 was awarded by the council of the Iron and Steel Institute to Mr. J. W. Dawson for his contributions to the development of steel casting.

Dr. Gilbert W. Robinson, professor of Agricultural Chemistry, University College of North Wales, was elected to a Fellowship of the Royal Society for his contributions to the study of soils.

Mr. D. G. Sopwith was appointed superintendent of the engineering division of the National Physical Laboratory, DSIR.

Prof. Sir John Cockroft, director of The Atomic Energy Research and Development Establishment, Harwell, was awarded the James Alfred Ewing Medal for 1947 by the Institution of Civil Engineers.

Sir Frederick Bain, M.C., was re-elected as president of the Federation of British Industries.

MAY

A resolution seeking the nationalisation of the chemical industry was passed at a meeting of the Chemical Workers' Union at Derby.

The Minister of Fuel and Power authorised the Liverpool Gas Company to install at their Linacre Works a liquid purification plant capable of dealing with 4-5 million cu. ft. of gas per day.

A British code of standards was published, designed to discourage unjustifiable claims in advertising of drugs, medicines, and treatments.

Imperial Chemical Industries, Ltd., announced plans for the collaboration of their Wilton and Billingham plants in production of petroleum chemicals.

Ciba, Ltd., acquired a controlling interest in Aero Research, Ltd., Duxford, Cambridge.

A remote control manipulator for performing delicate chemical experiments in dangerous areas was demonstrated in New York by scientists of the General Electric Co.

A Bill to create a National Science Foundation for basic scientific research was approved by the U.S. Senate.

The total value of chemical manufactures (excluding drugs and dyestuffs) was £3,876,628, an increase of £1,164,694 over May, 1947.

E.I. Du Pont de Nemours Company announced $30 million expansion for research facilities at their experimental station, Wilmington, Delaware.

A new textile material, Ardil, derived from vegetable protein, was described by Imperial Chemical Industries, Ltd.

The Coal Tar Research Association was set up by the British Tar Confederation, representative of producers and distillers of tar.

The report and accounts of Imperial Chemical Industries, Ltd., for 1947 showed that £13,335,000 had been spent on new construction and acquisition of war-time factories from the Government.

The U.S. Atomic Energy Commission announced a programme to stimulate the discovery and production of domestic uranium by private competitive enterprise.

Explosion and poison hazards in chemical and electrical industries, and methods of minimising their risks, were dealt with in a memorandum issued by the Factory Department of the Ministry of Labour.

The Chancellor of the Exchequer was asked to receive a deputation of the principal manufacturers of drugs, disinfectants and veterinary medicines to protest against the proposed 33⅓ per cent tax in the Finance Bill on such products bearing a branded name and trade mark.

The opening of the Shell Group research centre at Thornton-le-Moors, Cheshire, marked the beginning of a large scale oil chemistry undertaking.

Edinburgh Court of Session refused a reclaiming motion by the North British Aluminium Company against an earlier decision allowing proof in a petition for interdict against the company brought by the Ben Nevis Distillery (Fort William), Ltd. The case was accordingly to be the subject of a further hearing.

Mr. A. E. Sylvester was appointed chairman, and Col. H. C. Smith deputy chairman of the Gas Council.

Mr. David E. Roe was elected chairman of the London Section of the Oil and Colour Chemists' Association, at their annual meeting.

Dr. Leslie F. Wiggins, director of the chemistry department, Birmingham University, was awarded the £1250 sugar research prize sponsored by the United States Sugar Research Foundation and presented by the National Science Fund.

The Meldola Medal, 1947, was presented by the Society of Maccabaeans, on the recommendation of the Royal Institute of Chemistry, to Dr. James Baddiley for his contributions to nucleoside chemistry and related subjects (before he was 30).

Sir Alexander Fleming and Sir Howard Florey were awarded the U.S. Medal for Merit for discovery, research, and development work on penicillin.

The wide presentation at the British Industries Fair in 1948 of the fruits in industry of what is conveniently summed up as "applied science," deservedly created an excellent impression on foreign buyers. So far as chemical equipment was concerned, the various impediments to international trading seemed to have little effect, confirming the many recent indications of the world-wide attempts to provide at home some of the chemicals for which buyers have had to compete for a number of years. The attendance of foreign buyers was well up to previous levels.

JUNE

The Ministry of Supply gave notice to the Pharmaceutical and Allied Chemicals Disposals Association, Ltd., of its intention to terminate the agreement covering methods for the disposal of Government surplus stores of pharmaceutical products, which had afforded useful safeguards to the purchasing public.

The International Superphosphate Manufacturers' Association held its annual series of meetings in Brussels.

The Federation of British Industries paid its respects to science, in the persons of the 1947 Nobel Prize winners, Sir Robert Robinson (left) and Sir Edward Appleton (right) seen here with Sir Frederick Bain

The development of a new cast iron, distinguished by a nodular graphite structure, by British research workers was claimed to be the most notable metallurgical advance for years. The great value of this was later cordially acknowledged in the U.S.A.

The British Commonwealth of Nations Scientific Liaison Offices (London) were opened in Africa House, Kingsway, W.C.2.

The Lord President of the Council appointed the following to be members of the Chemistry Research Board, DSIR: Dr. A. L. Bacharach, head of the nutrition unit, Glaxo Laboratories, Ltd.; Prof. H. J. Emeleus, Professor of Inorganic Chemistry, Cambridge University, and Prof. D. M. Newitt, Professor of Chemical Engineering, Imperial College.

The 25th anniversary of the British Chemical and Dyestuffs Traders' Association, Ltd., was celebrated in London.

The foundation stone for the building of a new hydrogen peroxide plant of Laporte Chemicals, Ltd., was laid at the company's Walton Works, Warrington.

75th anniversary of the founding of Imperial Chemical Industries' Ardeer works at Steventon, Ayrshire, was celebrated by a dinner in Glasgow.

The preliminary official report was published on the Partial Census of Production, 1946 (Report No. 4) in respect of chemicals, dyestuffs and drugs.

The successful isolation, by Dr. E. Lester, of the obscure factor in liver extracts which is responsible for relieving Addisonian pernicious anaemia, was reported by Glaxo Laboratories, Ltd.

The Ministry of Supply made the Control of Iron and Steel (No. 64) Order increasing the maximum price of pig iron (other than common foundry iron) and finished steel.

The scientific information conference began at the Royal Institution, London, attended by more than 500 scientists to review methods of distribution of scientific information.

Total value of chemical exports (excluding drugs and dyestuffs) during the month was £3,893,387, compared with £3,056,900 in June the previous year.

Mr. Clement Shaw, chairman and managing director, T. C. Cornwell, Ltd., was elected president of the Pharmaceutical Society of Great Britain.

Dr. W. J. Worboys was appointed director of paints, plastics, and leather cloth at Imperial Chemical Industries, Ltd.

A scientific advisory committee was appointed by the B.B.C. to advise on the discussion of scientific research and its correlation with external activities, with Sir Edward Appleton as chairman, and Sir John Cockcroft vice-chairman.

Dr. Neurath, a regular contributor to THE CHEMICAL AGE, was awarded the Golden Doctor Diploma of the University of Heidelberg, recognising his distinguished career as a chemist in Austria.

Mr. Sydney Smith, production manager at Monsanto's Ruabon plant, was appointed works manager at the company's new works, Newport, Monmouthshire.

Chemical exports in June were announced as having achieved their highest monthly total of the year. Chemicals (exclusive of drugs and dyestuffs) aggregated £3,893,387.

JULY

Discovery of an extensive, easily accessible deposit of titanium minerals, source of the whitest paint pigments and from which the U.S. Bureau of Mines has developed a method of producing a white metal twice as strong as mild steel with very high corrosion resistance, was revealed in Report of Investigations 4208. Drilling in the vicinity of Highland, Clay County, Florida, disclosed an area of titanium-bearing sand from 3000 to 8000 ft. wide and about 19 miles long.

A limited relaxation of the existing regulations governing the acquisition of steel products was contained in the Control of Iron and Steel (No. 65) Order, which came into effect.

The first International Powder Metallurgy Congress was held in Graz from July 12 to 17 inclusive.

A discovery calculated to cause the Minister of Town and Country Planning to shelve his intention to establish a new satellite town for Manchester at Mobberley, was the substantial salt deposit revealed by engineers of the Geological Survey at the proposed site.

A report from Germany stated that a process for the production of artificial wood from peat had been developed in Hamburg. Under tests, a board made from this synthetic wood was stated to have supported greater loads than an oak plank of similar dimensions.

The summer school in chemistry of the Irish Chemical Association was held in the Department of Chemistry, University College, Dublin, from July 5 to 9 inclusive.

A report in the Canadian Government journal *Foreign Trade* announced the development of a process for manufacturing "high-tenacity" rayon from beechwood pulp, likely to effect a saving of approximately $1.5 million in imports during 1948.

An apprenticeship training scheme for the paint industry, was drawn up by the technical education committee of the Oil and Colour National Joint Industrial Council.

The first discovery of uranium in Manitoba was made nine miles north of the Snow Lake township.

Successful application of methods of improving the sinter, a mixture of Lincolnshire and Northamptonshire ironstone was announced by the Appleby-Frodingham Company, Scunthorpe. The process promised to produce a substantial increase in the company's steel output, it was announced.

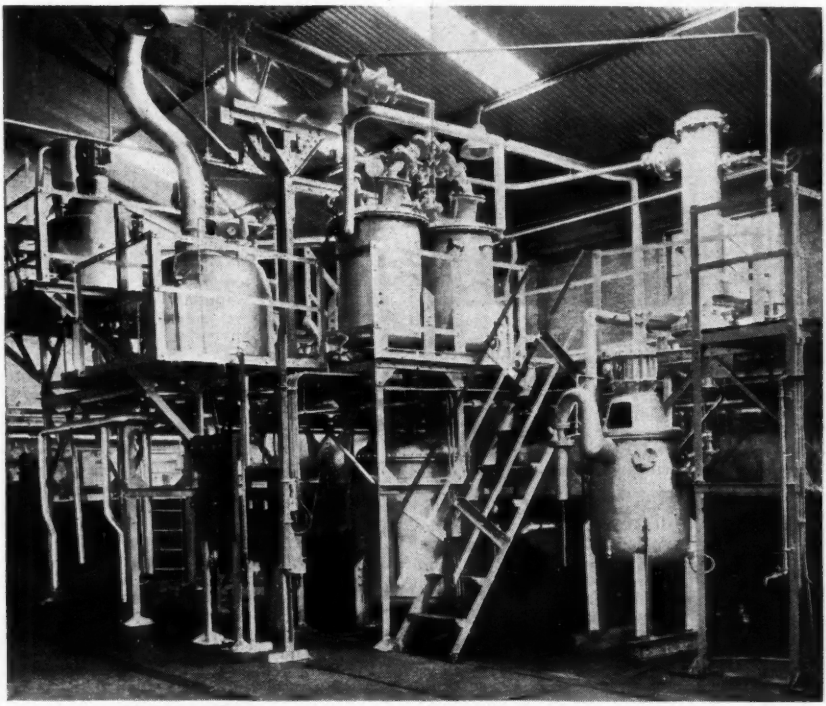
A new chemical process for the production of piezo-electric crystals which, in addition to its scientific value, may lead to a considerable saving in dollar expenditure, was announced as being developed at the Post Office engineering research station at Dollis Hill.

By the formation of Northern Chemicals, Ltd., with the aid of U.S. capital, Canada seemed likely to become a major contributor to the lithium industry. Northern Chemicals was developing what was believed to be the world's largest single deposit of ore in the Cat Lake area of Manitoba.

Claims to have adduced the first positive proof of the existence of the chemical element 43 and to have acquired the right to name element 61, by having produced the first pure samples of it, were advanced at a symposium organised by the American Chemical Society at Syracuse, New York. It was proposed that element 43 be named "technetium," and element 61 "prometheum."

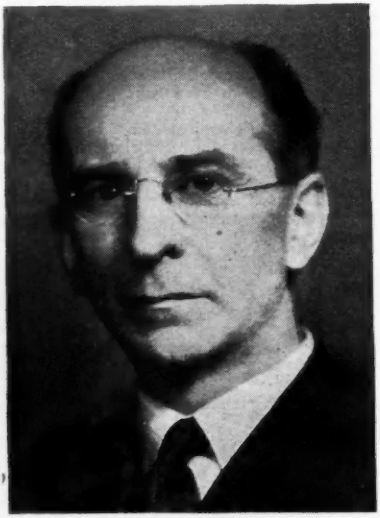
The acceptance by Sir David Rivett, K.C.M.G., F.R.S., of the presidency of the Society of Chemical Industry, 1948-9, was communicated to members in a personal message. Sir David was unable to leave Australia, where he fills many of the principal offices in scientific and chemical organisation.

The value of chemicals, excluding drugs and dyestuffs, exported from Britain during July —£4,520,840—was announced to be the highest monthly total so far in 1948.



The Thornton research centre of the Shell Group was opened at Thornton-le-Moors, Cheshire in May. The pilot plant, seen above, produces, in bulk quantities, additives for lubricating oils. Corrosion problems are eliminated by the use of stainless steel in the vulnerable sections

A symmetrical group of factory buildings resting upon 3200 concrete piles driven some 30 ft. into Grimsby's marshland; a specially built "pier" 1000 yards long to facilitate the discharge of effluent far out into the River Humber; three boreholes each capable of delivering 40,000 gall. of water an hour; these are features of the titanium pigment plant being constructed at the Pyewipe Industrial Estate, Grimsby, by the British Titan Products Co., Ltd.



Sir David Rivett

Dunlop Rubber Company announced that early in 1949 it would be producing tyres from a new factory being built at Upper Hutt, in New Zealand.

Murex, Ltd., Rainham, Essex, announced that it is now producing zirconium hydride, a product previously derived from the U.S.A.

Dr. Stanley Peat, Reader in Chemistry at the University of Birmingham, was appointed to the Chair of Chemistry at the University College of North Wales.

Mr. G. E. Beharrell, managing director of the Dunlop Rubber Company and president of the Tyre Manufacturers' Conference, was elected president of the Federation of British Rubber Manufacturers' Associations.

The death was announced of Dr. Francis W. Gray, former lecturer in chemistry at Aberdeen University. He was a notable research worker and the author of a number of scientific publications.

AUGUST

The successful development was reported from Sweden of a prefabrication method for very rapid construction in concrete, a method likely to be useful in the erection of chemical plant.

A disastrous explosion at the I.G. Farben establishment at Ludwigshaven reduced a large part of the factory area to ruins and killed and injured several hundred workers.

An Inter-Services Metallurgical Research Council was set up by the Admiralty and Ministry of Supply.

A Board of Trade Order came into force, requiring an export licence for dyestuffs and certain materials used in their manufacture.

A new publicly-owned sodium sulphate plant was opened by Mr. T. C. Douglas, Premier of Saskatchewan, at Chaplin, Regina, Canada.

The Davy-Faraday exhibition was held in Paris.

Development of many new chemical substances was reported in the annual review of Industry and Employment in Scotland, 1947, published by HMSO.

Confirmation of the discovery of two important mineral deposits—titanium near Lake Allard, 400 miles north-east of Quebec City, and uranium near Gunn Lake, 15 miles north of the gold mining town of Bralorne—was made by Canadian Government officials.

The British Council report for 1947-48 recorded that a large amount of scientific work was carried out, and technical information was supplied on education in chemistry and chemical research in this country in connection with the South American Congress at Santiago.

Total value of chemical manufctures (excluding drugs and dyestuffs) was £4,147,669, more than £1 million higher than the value of the same month last year.

Belgian interests erected a plant to produce liquid chlorine and its derivatives near Santo André, Brazil. This was the first factory of its kind to be established in the State of S. Paulo, and was also scheduled to produce benzene hexachloride.

Mr. Hugh Edmund Watts, chief inspector of explosives at the Home Office since 1945, was awarded the George Medal. This was in recognition of his courage and skill in opening and rendering safe the 22 explosive letters and packages sent to prominent persons in this country since 1945.

SEPTEMBER

Following several years' research and technological development to perfect a continuous

greasemaking process, output from a new plant at the Baltimore refinery of Esso Standard Oil Company, for large-scale production of lime soap greases by such means, was reported to be commencing. Employing lime, animal or vegetable fats, and oil, the continuous process for making grease was said to be likely to have important effects on greasemaking because of its speed, its economical use of fatty ingredients, and the uniformity of the finished product.

Chemicals and pharmaceuticals figured prominently in an agreement between India and Pakistan for the mutual supply of certain essential commodities.

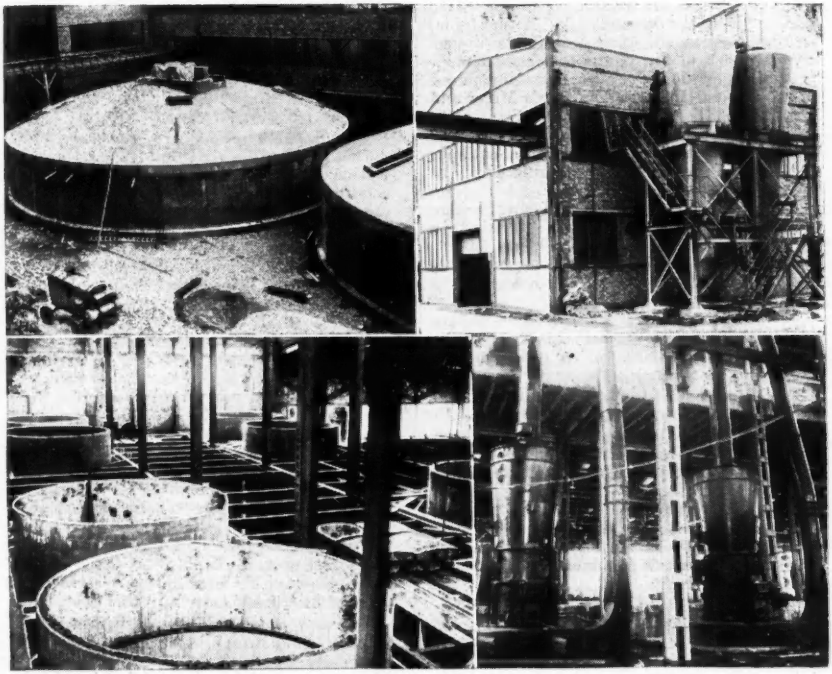
A licensing agreement was concluded between the Fairchild Engine & Airplane Corporation, New York, and Wellworthy Piston Rings, Ltd., Lymington, Hants., whereby the latter received an exclusive licence in the British Isles covering the use of Fairchild's Al-Fin process for bonding aluminium to iron, steel, and other metals.

Engineers at the (U.S.) General Electric Company's Schenectady, New York, works laboratory were stated to have developed what was colloquially described as an "eye-dropper" method for sampling molten steel at 2700° F. The implement is a heat-resistant glass tube, about the diameter of a lead pencil and 18-in. long, with a rubber bulb at one end, by which the molten sample is drawn into the tube, where it is rapidly cooled.

The casting of steel articles, from the liquid phase to semi-finished shape in one simple, relatively inexpensive machine, was rendered practicable in the U.S.A. by a joint development of the Republic Steel Corporation and the Babcock and Wilcox Tube Company, announced by both firms.

Further additions to the range of beryllium alloys for which special claims were made were specified in a series of British patent applications.

A large refinery was being built near



The large new titanium pigment plant of the British Titan Products Company at Grimsby, which is to be in operation this year. Top: The vast domed thickeners and (right) raw water treatment plant. Bottom: Digesters and (right) pigment grinding mills

Lt. Gen. Sir W. G. Lindsell

Rotterdam, Holland, for the Caltex Petroleum Company at a cost of between 50 million and 60 million guilders.

A new light-beam wattmeter, developed to meet industrial demands for a portable, accurate instrument giving readings in the low-wattage and low-power factor ranges for frequencies of 25,300 cycles, was announced by the General Electric Company's Meter and Instrument Divisions (U.S.A.).

Production began at the first oil-from-herring plant to be assembled in Scotland, established in Wick by the Herring Industry Board.

A 110 ft. long aluminium lifting bridge weighing 72 tons, the first of its kind in the world, built by Head Wrightson & Co., Thornaby, for the River Wear Commissioners, was transported on barges by river to Middlesbrough.

It was claimed that half a million dollars would be earned for Britain in 1949 by the announced development of a new type of bituminous anti-corrosive enamel by Wailes Dove Bitumastic, Ltd., Hebburn-on-Tyne, for use on pipe lines in the Middle East.

A great deposit of titanium, possibly the world's largest, was reported to have been discovered in Eastern Quebec. Plans were announced for a $25 million project to develop the deposit.

A conference on " Dust in Industry " was held by the Society of Chemical Industry, from September 28-30 inclusive, at the University of Leeds.

The development of a new chemical which is stated to kill the fungi responsible for athlete's foot, ringworm of the scalp, and plant losses estimated at more than two billion dollars a year, was reported by Dr. F. E. Cislak, director of research of the Reilly Tar and Chemical Corporation, Indianapolis, Ind., U.S.A. The synthetic product, called Echedrine, was said in laboratory tests to have proved effective against fungi, even when diluted to one part in 150,000.

Steel production for August was announced to have reached the highest figure ever recorded for that month, at an annual rate of 14,117,000 tons.

An important development in pump design was introduced by Tungstone Products, Ltd., with the demonstration of a new glass pump. Made of Pyrex borosilicate glass, it was said to make practicable the safe conveying of all acids and alkalis of pH-8 or less (concentrated hydrofluoric and glacial phosphoric acids excepted).

Discovery of a new pain killing drug many times more potent than cocaine was claimed at the 114th national meeting of the American Chemical Society.

A new substance, Neodrenal, for the treatment of bronchial asthma was announced by Savory & Moore, Ltd. It was stated to be more effective than adrenalin in relaxing artificially-induced bronchospasm, and to produce no rise in blood pressure, and unpleasant side effects were slight.

The ninth International Congress on Industrial Medicine was held in London during the week ending September 17, under the chairmanship of the Rt. Hon. Lord Webb-Johnson, K.C.V.O., C.B.E., D.S.O., T.D., president of the Royal College of Surgeons.

Dr. Willard H. Bennett, of the U.S. National Bureau of Standards, investigating conditions for the formation of negative atomic ions of the heavier metallic element, was announced to have succeeded in developing a vacuum tube specially designed to provide a greatly simplified and flexible radio-frequency mass spectrometer for detecting, separating, identifying and measuring such ions.

The invention was announced, by technicians at the British Railways paint laboratory at Derby, of a new " self-cleaning " white paint for use on equipment required always to be conspicuous—such as signals. The process, known as " controlled chalking," consists of the flaking off of the old coat of paint leaving a new clean material below. Similar paint in other colours can be produced. The process was not revealed.

Lt.-Gen. Sir W. G. Lindsell, G.B.E., K.C.B., D.S.O., M.C., was elected chairman of Petrochemicals, Ltd.

Mr. Thomas F. Laurie, was elected chairman of the Irish-American Oil Company.

Professor Douglas McCandlish, head of the Leather Industries Department of Leeds University, was elected the first honorary life member of the Society of Leather Trades' Chemists.

Mr. Meredith Gwynne Evans, D.Sc. (Manchester), F.R.S., was appointed to the

Chair of Physical Chemistry at Manchester University.

Mr. H. Constant was appointed director of the Ministry of Supply's National Gas Turbine Establishment.

Dr. William Ogilvie Kermack, bio-chemist at the Royal College of Physicians' Laboratory, Edinburgh, was appointed to the new MacLecd Smith Chair of Biological Chemistry by a meeting of Aberdeen University Court.

Mr. A. J. Quig, was appointed a deputy chairman of I.C.I., Ltd., the other deputy chairmen being Sir Frederick Bain, Sir William Coates, and Mr. J. Rogers.

OCTOBER

The British drug sulphetrone was reported to be increasingly used in the fight against leprosy. Exports were rising steadily, and at present nearly all the output was being sent to countries in the tropical belt.

Large quantities of lead near King Oscar Firth on the east coast of Greenland, were reported, on returning from his expedition, by Hr. Lauge Koch, the distinguished Danish explorer. He also claimed to have discovered some uranium, but said it was too early to estimate the quantities.

The Board of Trade announced that the price of liquid rosin distributed through the agency of the Liquid Rosin Importers' Association, Ltd., would be reduced by £6 per ton, to £32 per ton as from October 1, ex United Kingdom warehouse.

Representatives from Belgium, Czechoslovakia, Denmark, France, Holland, Norway, Sweden, U.S.A., and the United Kingdom were among the 130 scientists and technologists who attended the joint meetings of the International Commission on Glass and the Society of Glass Technology at Sheffield and Buxton. Discussions dealt with the atomic structure and surface chemistry of glass.

A report was issued by the Association of British Chemical Manufacturers on its goodwill mission to Czechoslovakia. Among the principal chemical undertakings visited were the factory at Novaky, planned to become the centre of the country's acetylene industry; the dyestuffs works at Rybitvi; the rayon plant at Neratovice and the 100-year-old soapworks at Schicht.

The second International Scientific Film Congress held in London, was attended by delegates from more than 20 countries. Sir Robert Watson-Watt presiding, commended the cinematograph film in its application to scientific research and Dr. S. Fordham (Imperial Chemical Industries, Ltd.), spoke on "The Film as a Research Tool in Chemistry."

The stepping-up of production of magnesia from sea water from 27,000 to 40,000 tons a year was announced by Mr. Jack Jones,

Mr. A. J. Quig

Joint Parliamentary Secretary to the Ministry of Supply, when he visited the British Periclase Co., Ltd.'s Palliser Works, Hartlepool.

After 106 years, the College of the Pharmaceutical Society ceased to exist in its old form, but continued in a new status as the School of Pharmacy of London University.

First experiments in crop spraying using a British-built Westland Sikorski S.51 helicopter were tried out in Egypt.

Mr. Harold Wilson, President of the Board of Trade, was the principal guest at the annual dinner held in London of the Association of British Chemical Manufacturers. Sir Harry Jephcott proposed the toast of "The Guests" and gave an able review of the scope of the industry today and some of its major problems. Mr. Harold Wilson in his reply said that the first charge on the industry had been essential supplies for home industries, but a considerable contribution to the export drive had also been made.

The first meeting of the Anglo-American Productivity Council was held in London to exchange views on how, through ERP and otherwise, U.S. industry could co-operate in assisting British industry to promote greater productivity. Sir Frederick Bain, vice-president of the Association of British Chemical Manufacturers, presided.

After the opening of the British Exhibition in Copenhagen, Sir Frederick Bain was honoured by King Frederick of Denmark, who conferred upon him the Order of Danneborg.

Professor M. L. E. Oliphant, Professor of Physics at Birmingham University since 1937, was appointed director of post-graduate research in the School of Physical Science at the National University of Australia.

NOVEMBER

A non-profit making organisation, jointly financed by industry and the Government, the Production Engineering Association, was

established at Staveley Lodge, Melton Mowbray. It is under the presidency of Lord Riverdale.

Some 200 delegates, most of whom hold executive positions in chemical manufacturing concerns throughout the country, attended a conference on accident prevention in chemical works, held at the Grand Hotel, Harrogate. The conference was sponsored by the Association of British Chemical Manufacturers and was organised on its behalf by the Royal Society for the Prevention of Accidents.

The text was published of the Iron and Steel Bill, setting out the Government's plans for control by the State of British iron and steel production, embracing, it was proposed, 107 key undertakings and their numerous and varied subsidiary companies unconnected with steel production.

A considerable proportion of the controls dispensed with by the Board of Trade and the Ministry of Supply were of direct interest to the chemical industry.

The Winnington Works of Imperial Chemical Industries, Cheshire, one of the largest alkali producers in the world, celebrated its 75th anniversary on November 20. A £13 m. alkali extension was announced.

The rôle of the gas industry as a supplier of tar and tar chemicals, rubber accelerators and materials for the plastics and other industries, was given prominence at "The Nation's Wealth" exhibition which opened on November 8, at Gas Industry House, Grosvenor Place, London, S.W.1

A new factory officially opened in the Possilpark district of Glasgow by Fibreglass, Ltd., is to be used for producing yarn from glass fibre.

A widely based scheme elaborated by the British Plastics Federation and the British Standards Institution to procure the use of identifying marks on containers of plastics moulding powders and articles made of plastics was introduced at a meeting organised by the two bodies in London. The scheme, which has its roots in earlier efforts to the same end which had to be suspended during the war, will at first be restricted to phenol formaldehyde and urea formaldehyde moulding powders and articles made from them.

The half-yearly meeting of the Association of British Pharmaceutical Industry, held at Bournemouth under the chairmanship of Dr. C. A. O. Rideal, was attended by more than 60 representatives of member firms.

The president of University College, Dublin, Mr. Michael Tierney, opened there a new laboratory of chemical technology, to be known as the "Nolan" laboratory in remembrance of the late Prof. T. J. Nolan. Mr. Tierney also opened a laboratory for final years' honours chemistry, which will be known as the "Ryan" laboratory in remembrance of the late Prof. Hugh Ryan, the first professor of chemistry in University College, Dublin.

The Royal Swedish Academy of Science on November 4 awarded the Nobel prize in chemistry to Prof. Arne Tiselius, of Upsala University, Sweden. The prize for physics was awarded to Prof. P. M. S. Blackett, of Manchester University. It was announced that Dr. Paul Moller, of Basle, was to be awarded the Nobel prize for medicine in recognition of his discovery of the insecticidal effect of DDT.

The death was announced of Viscount Bearstead, who was chairman until 1946 of the Shell Transport and Trading Company.

The official report was issued of the research into the prevention of explosions, in store and during transport, of ammonium nitrate. This had been carried a stage further during the period September 29 to October 3, when three trials, arranged by the Explosives Storage and Transport Committee at the instance of a Home Office working party, took place off the island of Dune (Germany), near Heligoland, to examine the effects of fires on commercially pure bulk NH_4NO_3. Throughout the tests there was no evidence of any explosion having occurred.

The increasingly important functions of the chemist in the contemporary development of public health safeguards were fully represented at the Public Health and Municipal Engineering Exhibition at Olympia, London (November 15-20).

Some practical contributions, in a specialised field, to the recent information on safety measures in chemical works were made at the conference held in London by the Institute of Physics in collaboration with the Institution of Metallurgists. This put into effect a proposal originating with the Royal Institute of Chemistry.

The annual exhibition of the British Leather Manufacturers' Research Association was held on November 25, 26 and 27, in the Assembly Hall of the Royal Empire Society, Northumberland Avenue, London, W.C.2.

The excellent export performance of the chemical industry this year was borne out by the figure for October, published in November. The value of chemicals, excluding drugs and dyestuffs, exported from the United Kingdom in October was stated to be £4,104,857.

The announcement was made by I.C.I., Ltd., that the first of a variety of fluorine compounds to be produced in this country would be available early in 1949.

Describing electronics as one of the most fruitful branches of science, Sir Edward

Appleton, director of the Department of Scientific and Industrial Research, opened a symposium on electronics in scientific research arranged by the Scientific Instrument Manufacturers' Association at Caxton Hall.

Following a study, begun during the war, of methods of splitting mica, scientists at the U.S. National Bureau of Standards were announced to have succeeded in producing a mechanical mica splitter in the search to find a means of producing thin films more rapid than the tedious hand method commonly employed.

At the London Medical Exhibition, held at Central Hall, Westminster, from November 15 to 19, numerous new products from British laboratories were shown.

At the annual meeting of its research experts, the Royal Dutch-Shell group adopted a £6 million budget for oil research in 1949.

DECEMBER

The 286th anniversary meeting of the Royal Society, was held in London. In his address, Sir Robert Robinson, the president, referred to the creation of a science centre which would probably involve the Society's departure from Burlington House, to function as the heart of such a centre located elsewhere.

Sir Henry Dale, president of the Royal Society 1940-45, announced his resignation from honorary membership of the Academy of Science, U.S.S.R.

Application for an interdict against the North British Aluminium Co., Ltd., to prevent the company manufacturing aluminium at their Fort William factory by any means which might release noxious fumes was continued in the Scottish Court of Session. The applicants were Ben Nevis Distillery (Fort William), Ltd.

Developments in the manufacture and character of scientific glassware were reported from Wales, where H. J. Elliott, Ltd., on the Treforest Trading Estate, is increasing its output of high-grade chemical glassware of guaranteed standards of accuracy.

An agreement on the standardisation of screw threads was signed in Washington between Great Britain, the United States and Canada.

Castings made in the United States by the British-developed centrifugal casting process were on view for the first time at the National Power Exposition held in New York.

Prof. Hermann Joseph Muller, the American geneticist, resigned from the Soviet Academy of Sciences.

Reorganisation was announced of Brotherton & Co., Ltd., the 70-year-old firm of chemical manufacturers, Leeds. The firm is to be divided into a public company of the same name with capital of £1275 million and a private investment trust controlled by the Brotherton family with a capital of £1475 million.

France's first atomic pile was set in operation at the Fort de Chatillon on the southern outskirts of Paris.

A four-year programme providing for the expansion of the United Kingdom's chemical industry at the rate of £200 million a year was part of the Government's economic plan submitted to the Organisation for European Economic Co-operation.

Sir Edward Appleton, secretary of the Department of Scientific and Industrial Research, was awarded the Valdemar Poulsen gold medal by the Danish Academy of Technical Sciences for his contributions to radio technics and particularly his achievements in research on the ionosphere. Sir Edward was also appointed principal and vice-chancellor of Edinburgh University. This will later necessitate his resignation from the secretaryship of the DSIR.

Dr. Ernest H. Volwiler, executive vice-president of Abbott Laboratories, North Chicago, Illinois, was chosen president-elect of the American Chemical Society.

Personal News of the Week

The Minister of Food has appointed MISS B. C. HOBBS, Ph.D., B.Sc., Dip.Bact., supervisor of the Food Hygiene Unit of the Central Public Health Laboratory, Colindale, to be an additional member of the working party set up to make recommendations for the improvement of hygienic conditions in the catering trade.

MR. GEORGE ARCHER and MR. L. K. BRINDLEY have been appointed directors of the Mond Nickel Company.

MR. A. W. SCOTT, director of Shawinigan, Ltd., electro-chemical specialists, London, since 1945, has now been appointed managing director.

MR. EMILE E. SOUBRY, a former chairman of the Anglo-American Oil Company, has been appointed a director of the Standard Oil Company (New Jersey, U.S.A.).

Courtaulds, Ltd., announce that MR. G. T. VERRALL has been appointed director and chief engineer.

MR. A. SANDERCOCK, deputy chairman and deputy managing director of Glaxo Laboratories, Ltd., left estate "so far as can at present be ascertained" £114,418.

MR. FREDERICK FELIX GORDON, of Sheffield, joint managing director of Spear & Jackson, Ltd., steel manufacturers, left £55,063.

American Chemical Notebook

From Our New York Correspondent

WHAT is said to be the first completely equipped plastics laboratory available to the plastics industry for independent testing and research development, has been opened by the United States Testing Company, Hoboken, New Jersey. Installed after a year's planning, the project consists of specially designed air-conditioned rooms, high-pressure moulding presses, a 150,000-volt machine for dielectric strength tests, low temperature cabinets capable of conditioning plastics as low as minus 100° F., and even facilities for preparation of test specimens of denture base materials. Hitherto, outside of the laboratories of those who produce the basic materials, plastic moulders and fabricators have had no independent laboratory available where comparative tests could be made, product development investigation conducted and final products tested for performance and use. The plastics laboratory also has access to the company's chemical and textile divisions.

* * *

Formally opening the first section of its new laboratory building at the Knolls, Niskayuna, New York, near Schenectady, Mr. Charles E. Wilson, president of the General Electric Company, said that completion of the new research centre, being erected at a total cost of $18 million, is now under way. It is expected that the complete laboratory will be ready by 1950, when the formal dedication will take place.

* * *

American Anode, Inc., Akron, Ohio, last week announced the development of a new latex compound especially designed for applications requiring high heat resistance, and a new series of plastisols. The company define the latter as a dispersion of resin and other compounding materials in a plasticiser containing no volatile organic liquids as diluent. The new products will be marketed under the trade names Anodex HR latex and Ameran resin paste. The former is said by the company to be "the only known stable latex compound that possesses a combination of high heat resistance, good chemical resistance, high elongation, and high tensile strength." Articles treated with it are said to be able to withstand temperatures as high as 400° F., to retain tensile strengths up to 2500 p.s.i. and elongations up to 1000 per cent. The new series of Ameran resin pastes provides processes with plastisol compounds that are free from entrapped air, which is said formerly to have been the greatest single difficulty with plastisols.

* * *

Employment in the U.S. chemical industry, not including allied products, reached a record high level during August, 1948, with a total of 211,200 production employees, compared with an average of about 205,000 during 1947, and 70,400 in 1939. Employees' earnings, likewise, were at a record level, averaging $63.62 per week as compared with $57.44 during 1947.

* * *

Additional information about the "mechanical miner" which seems capable of effecting big economies in coal raising costs—in the U.S.A. at least—was released last week. Stated to be capable of "digging a ton of coal in thirty seconds," this $50,000 mining machine has been developed by the Joy Manufacturing Company, one of the largest makers of mining equipment, and purchased by the Pittsburgh Coal Company which recently offered a public demonstration of the machine in its new Mathies mine, near Pittsburgh. The mechanical miner has been successfully tested on bituminous coal and the manufacturers now claim it will be equally effective in hard coal mining. It raises the speed of mining by replacing with one continuous operation the conventional separate steps of cutting, drilling, blasting and loading. The machine, 25 ft. long, and 34 in. high, has a ripper bar of carbide bits, acting like picks, which tear the coal from the face and discharge it into a conveyor belt to be carried to hopper or shuttle cars.

New Chilean Copper Plant

Negotiations have been completed between the Chile Exploration Company and the Chilean Government for construction of a new $130 million plant for the treatment (concentrating, smelting, and refining) of copper-sulphide ores at the Chuquicamata mines. Of the total investment required for these facilities, $60 million will be spent during the first four years. It is estimated that the new plant will increase the copper output of Chuquicamata mines from 243,565 short tons for 1947, as reported by the American Bureau of Metal Statistics, to about 270,000 short tons. The negotiations include agreement on the amortisation and tax rates.

Overseas News Items

Plate Glass Exports.—All limitations of exports of plate glass from Italy have been abolished.

ECA Aid for Austrian Steel.—The Economic Co-operation Administration has approved the use of $4.3 million for the construction of a blooming mill to produce steel ingots for the Alpine-Moatan Gesellschaft, Austria's largest steel company. It will be located in Donawitz in the Austrian Alps.

Dumping of Rayon Alleged.—The "continued dumping of British rayon goods in the Eire market and the absence of any protection for the home industry," is given by the directors of Seafield Fabrics, Ltd., Youghal, County Cork, which began production two years ago, as the reason why the factory is being obliged to close. About 120 employees will be affected.

Atomic Energy for Ship Propulsion.—A contract for the construction of an experimental pile in the hope of developing an atomic engine for ship propulsion has been given to the Westinghouse Electric Corporation by the U.S. Atomic Energy Commission. The work will be carried out in co-operation with the Argonne National Laboratory, the requirements for the pile being set by the Navy Department's Bureau of Shipping.

Syrian Pipelines.—The Syrian Prime Minister, Khaled el Azem, has stated that his Cabinet is considering new offers from the Anglo-Iranian Oil Company and the Trans-Arabian Pipeline Company for running pipelines across Syria. The latter company is understood to have proposed running pipelines from Saudi Arabia to the Mediterranean through Syria. The Anglo-Iranian proposal is said to be for a pipeline across Syria, having in mind the possibility of erecting a refinery in Syria. The Irak Petroleum Company is also reported to be proposing construction of a new 32-in. pipeline.

Christmas Island Phosphates.—On January 1 Australia and New Zealand obtained possession of the high-grade phosphates—estimated at 30 million tons—on the remote Christmas Island in the Indian Ocean, off the Java coast. The contract, which amounts practically to the purchase of Christmas Island, was negotiated in October, 1948, by the two Governments and the English Christmas Island Phosphate Company. Mr. Harold Gaze, on behalf of the British Phosphate Commissioners, signed an agreement to pay £2.75 million sterling for the phosphate.

Big Increase in Chemical Fertilisers.—The Finsider chemical factories in Italy report that their output of chemical fertilisers during the first three quarters of 1948 reached 93,200 tons (56,000 tons during the corresponding period in 1947).

Chilean Sugar Beet Plans.—The Corporación de Fomento de la Producción is reported to be planning the erection of 10 sugar-beet factories throughout Chile at a total cost of 156 million pesos. The first plant will be located at Los Angeles, near Concepción, and is expected to commence working next April.

U.S. Aluminium Production.—Primary aluminium production in the U.S.A. in September totalled 53,255 short tons, a decline from the August output of 1698 tons or 3 per cent. Despite the decrease proportionate to the shorter month, however, apparent consumption remained at a high level, and demand continued to exceed supply.

Canadian Potash.—J. M. Cantor, secretary-treasurer of the Canadian Community Petroleum, Ltd., has announced that potash has been discovered on an oil-drilling site half-a-mile from North Battleford, in north-western Saskatchewan. He said a salt bed with two zones was struck below 2700 feet containing a low potash content. Samples have been sent to the University of Saskatchewan for analysis. Potash was discovered earlier at the Unity Saskatchewan, oil field.

Skoda Oil Plant for Brazil.—A contract is reported to have been signed with the Skoda works for the construction in Czechoslovakia, under U.S. patents, of the equipment for the oil refinery to be erected in the State of S. Paulo. The cost of this equipment may exceed the total of Brazil's accumulated balances in Czechoslovakia—said to amount to about 650 million crowns—and it has been mutually agreed between the two Governments that any difference shall be paid with Brazilian raw materials.

International Fair of Ghent.—A special British Pavilion will be a feature of the International Fair of Ghent to be held from September 10-25. To save exhibitors difficulties of standfitting overseas, the rental includes provision by the organisers of a shell stand. Application for space should be made to the British Pavilion Ghent Fair, 395a Edgware Road, London, W.2 (AMBassador 4147); Robertson Buckley & Co., Ltd., Bereys Buildings, George Street, Liverpool, 3; or S. R. Tippett & Co., Ltd., Cannon Street House, Cannon Street, London, E.C.4.

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsibe for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

INTERNATIONAL LABORATORIES, LTD., London, S.W. (M., 8/1/49.) November 24, charge, to Barclays Bank, Ltd., securing all moneys due or to become due to the bank; charged on Glan Dwr, Blakes Lane, New Malden. *Nil. May 6, 1948.

KEYSTONE METAL PRODUCTS CO., LTD., London, N. (M., 8/1/49.) November 19, £6560 debentures; general charge. *Nil. October 14, 1948.

NORTH BRITISH ALUMINIUM CO., LTD., London, E.C. (M., 8/1/49.) November 17, supplemental Trust Deed dated November 10, 1948, securing £5,000,000 3 per cent debenture stock of British Aluminium Co., Ltd., and premium of 1 per cent (being £3,500,000 secured by Trust Deed dated July 30, 1947, and £1,500,000 secured by Trust Deed dated November 10, 1948), present issue £1,500,000; charged on specified properties, shares, etc., as charged by Trust Deed dated July 30, 1947. *—. March 30, 1948.

SUPERVENTS, LTD., Sidcup Bye-Pass. (M., 8/1/49.) November 24, £2000 further charge (supplemental to a charge dated December 29, 1947), to United Friendly Insurance Co., Ltd.; charged on lands and buildings at Sidcup Bye-Pass, Foots Cray. *£1137. November 26, 1947.

Satisfactions

BIRMINGHAM CHEMICAL CO., LTD., Lichfield. (M.S., 8/1/49.) Satisfaction November 24, of debenture registered October 11, 1933.

BRITISH DIESEL OIL & PETROL CO., LTD. (formerly L. T. C. DISTILLATES, LTD.), London, S.W. (M.S., 8/1/49.) Satisfaction November 22, of debenture registered.

FERGUSON EDWARDS, LTD. (formerly FERGUSON EDWARDS & CO. (LONDON), LTD., London, W. (M.S., 8/1/49.) Satisfaction November 19, of charge registered January 27, 1948.

SOLIDOL CHEMICAL, LTD., London, S.E. (M.S., 8/1/49.) Satisfaction November 23, of mortgage registered May 15, 1939.

Company News

The following increases in registered capital are announced: **Geigy Co., Ltd.**, from £400,000 to £500,000; **Middleton & Co., Ltd.**, from £10,000 to £20,000.

The name of **Johnson & Sons (Manufacturing Chemists), Ltd.**, has been changed to **Johnsons of Hendon, Ltd.**

New Companies Registered

Aircel, Ltd. (462,690). Private company. Capital £1000. Cold storage and refrigeration engineers, manufacturers of freezing mixtures, etc. Directors: L. J. Ayers, H. C. Selby. Reg. office: Gosmoor Lane, Elm, Wisbech, Cambs.

Alcodite, Ltd. (462,514). Private company. Capital £100. Electrical, research, chemical and precision engineers, metal and alloy makers, etc. Reg. office: 110a Market Street, Barking.

Airothene, Ltd. (462,401).—Private company. Manufacturers of plastic and synthetic materials; chemical engineers, etc. Directors: A. M. S. Will, A. H. Tucker, E. Brust. Reg. office: 24 St. Mary Axe, E.C.3.

Cranton Chemical Co., Ltd. (462,110).—Private company. Capital £1000. To acquire the business carried on by E. S. Stanley as "The Cranton Chemical Co.," at 35 Byrom Street, Manchester. Manufacturers of dyestuffs, pigments, chemicals, etc. Director: E. S. Stanley. Reg. office: 212 Brunswick Street, Chorlton on Medlock, Manchester, 13.

Machlett X-Ray Tubes (Great Britain), Ltd. (462,133). Private company. Capital £100,000. Manufacturers of X-ray tubes and valves, etc. Directors: L. C. Gamage, A. J. Minns, R. R. Machlett. Reg. office: 33 Newton Street, W.C.2.

Chemical and Allied Stocks and Shares

THIS week there have been two main factors influencing markets, namely, the tendency to await the reaction of gilt-edged stocks to terms of the latest Australian conversion loan, and the good impression created by the FBI memorandum to Sir Stafford Cripps. The Chancellor of the Exchequer stresses the urgency of providing more capital for industry, necessitated by the financing of larger stocks and the heavy cost of replacing fixed assets. The FBI asks for tax reforms, and this has induced slightly more hopefulness regarding the next Budget.

Shares of chemical and kindred companies

were firm generally with Imperial Chemical active around 49s. at which the yield is slightly more than 4 per cent. Monsanto were again 62s. 6d., Fisons 59s., Albright & Wilson 31s., and Burt Boulton 28s. 9d. British Glues were close on 22s. at which there is a yield of 4½ per cent. Lawes Chemical 10s. shares were 13s. 9d., and William Blythe 3s. shares 20s. Borax Consolidated strengthened to 63s. 9d. and now yield rather less than 3⅞ per cent; but this is an instance where, in the market view, there would be a higher payment for shareholders if dividend limitation were abolished.

Still influenced by the financial strength and high earning power disclosed by the consolidated accounts, Turner & Newall rose further to 84s. 6d. Yield on the latter is now only 3½ per cent, but this is another instance where Sir Stafford Cripps's request prevents a higher dividend.

British Aluminium were again slightly below 51s. British Oxygen changed hands around 102s. Here also there is only a small yield, but earnings on the shares are much in excess of the dividend payment, and moreover the market assumes that the expected capital increase when made will take the form of an offer on attractive terms to shareholders.

Shares of companies connected with plastics were inclined to attract more attention because of the good yields ruling in most cases. British Industrial Plastics 2s shares were 6s. 9d. yielding over 5¾ per cent, De La Rue 37s. 6d., and British Xylonite £5¾. Kleemann 1s. shares rallied to 22s. 6d. The full report points out that purchase tax changes affected business last year, and the directors' remarks as to the future are cautious.

The 4s. units of the Distillers Co. changed hands around 29s. 1½d. and British Plaster Board after rising above 25s. eased to 24s. 6d. United Molasses have been steady at 50s. 9d. Iron and Steels moved narrowly, but were inclined to strengthen, it being pointed out that yields are attractive and that dividends can be expected to be maintained until nationalisation is effected, which cannot be before May, 1950, at the earliest.

Boots Drug have been firm at 56s. 3d. on market talk of record profits, but it is realised that shareholders cannot be expected to benefit until the dividend limitation is lifted. Beechams deferred kept at 17s. 10½d. Lever & Unilever were 51s. 4½d. at which the yield is only 3⅞ per cent. In fact the yield on many leading industrial shares is now less than 4 per cent, reflecting hopes that the next Budget may remove or modify dividend limitation. Colliery shares have continued to attract attention on the view that compensation for coke-oven and other "outside" assets may be satisfied by cash payments this year. Oils showed firmness and were more active with Anglo-Iranian up to £9½, V.O.C. £7½, Shell 76s. 3d., and Trinidad Leaseholds 5s. units 32s. 2d. Elsewhere, another big jump in Glass Laboratories to £24¾ was a feature.

British Chemical Prices

Market Reports

THE chemical markets have entered the New Year with no outstanding changes to record other than an advance in the price of white lead and lead oxide owing to the increase in the price of the metal. Quotations generally remain on a firm basis and the overall demand continues to be of fairly substantial dimensions. The volume of export inquiry also remains satisfactory. Contract replacement bookings have occupied a good deal of attention and there has been a fairly strong inquiry for most of the soda compounds, the supply position of which is somewhat less difficult. Both grades of permanganate of potash have been in good call and the demand for the other potash chemicals remains in excess of available supplies. Among the miscellaneous items, there is a good inquiry for white powdered arsenic, formaldehyde and bleaching powder; supplies of barium chloride continue to be scarce. The new price for dry white lead is £146 per ton and ground in oil £167 10s. per ton. The price of dry red lead is now £137 10s. per ton and ground in oil £159 10s. per ton. Business in the coal-tar products market has been reasonably satisfactory and the home demand well maintained. Export trade in pitch is again good, but there is room for improvement in the volume of shipments of ADF cresylic acid.

MANCHESTER.—Steady trading conditions have been reported on the Manchester chemical market during the past week, and the flow of new inquiry is gradually regaining the pre-holiday level. The Lancashire textile bleaching, dyeing and finishing trades are calling for deliveries of a wide range of heavy chemicals, and this is also reported of the West Riding woollen and allied industries and other industrial users. Prices generally are on a steady to firm basis, though there has been a reduction of 2s. per cwt. in percarbonate of soda, bringing the current value to £7 9s. 9d. per cwt., in drums, less 1½ per cent. British-made barium chloride fine white crystals is now on offer on the basis of £35 10s. per ton, in 2-ton lots.

Next Week's Events

MONDAY, JANUARY 10

Textile Institute (Oldham branch). Technical College, Ascroft Street, Oldham, 7.30 p.m. Mr. Higgins (I.C.I. Ltd., Manchester): "Plastics for Textiles."

TUESDAY, JANUARY 11

Institution of Chemical Engineers, London. Geological Society, Burlington House, W.1, 5.30 p.m.

Textile Institute (Bolton Branch). Technical College, Manchester Road, Bolton. Prof. J. B. Speakman.

Society of Instrument Technology. Manchester College of Technology, 7.30 p.m. G. P. L. Williams: "Sources of Information Relating to Instruments."

Institute of Works' Managers, Ltd. (Merseyside Branch). Exchange Hotel, Liverpool, 6.30 p.m. D. G. Petrie: "Costing to Aid the Works Manager." (West Midland Branch). Grand Hotel, Birmingham, 7 p.m. L. C. Ord: "A Comparison between American and British Production." (West Yorkshire Branch). George Hotel, Huddersfield, 7 p.m. F. E. Chappell (Board of Trade): "Production: How to Achieve Greater Efficiency."

Royal Statistical Society (Industrial Applications Section, Tees-side sub-group). Cleveland Scientific and Technical Institute, Middlesbrough, 7.15 p.m. W. T. Hale: "Elementary Regression Analysis."

Institute of Metals (South Wales Local Section). University College, Singleton Park, Swansea, 6.30 p.m. Films of Metallurgical Interest.

The Royal Institute of Chemistry jointly with the Gravesend and District Engineering Society, Royal Clarendon Hotel, Gravesend, 7.30 p.m. W. J. Sparkes: "Efficiency and Smoke Emission of Lancashire and other Shell-type Boilers."

WEDNESDAY, JANUARY 12

Society of Chemical Industry, joint meeting with the Society for Applied Bacteriology, Medical Society of London, 11 Chandos Street, London, W.1, 2.15 p.m. Dr. M. C. Rayner: "Mycorrhiza and the Growth of Farm Crops"; Dr. G. K. Frazer: "Micro-organisms in relation to the Production and Degradation of Soil Organic Matter"; Dr. P. W. Brian: "Soil Antibiotics."

Textile Institute (Macclesfield, Leek and District Section). King's School, Macclesfield, 8.0 p.m. G. R. Moxon: "The Linking of Science and Craftsmanship in Textile Dyeing and Printing."

Institute of Fuel (Manchester). Engineers' Club, 2 p.m. F. Bell: "Distribution of Gaseous Fuel."

Manchester Statistical Society, Manchester Reform Club, King Street, 5.30 p.m. Prof. W. Arthur Lewis.

Society of Dyers and Colourists (Northern Ireland Section). Queen's Hotel, Belfast, 7.30 p.m. J. G. Grundy: "The Dyeing of Nylon in Union with Other Fibres."

THURSDAY, JANUARY 13

Chemical Society, Edinburgh. Joint meeting with Royal Institute of Chemistry and Society of Chemical Industry, North British Station Hotel, 7.30 p.m. Dr. R. T. Bolam: "Amphipathic Behaviour in Colloid Systems."

Institution of Works' Managers, Ltd. (Wembley Branch). Rest Hotel, Kenton, 12.30 p.m. J. L. Hardy (Kodak, Ltd.): "A Recent Visit to America."

British Institute of Management, London, 17 Hill Street, W.1. Winter proceedings. Paper No. 2. Lt.-Col. L. Urwick: "Problems of Growth in an Industrial Undertaking."

The Pharmaceutical Society, London, 17 Bloomsbury Square, W.C.1. 7.30 p.m. Agnes Lothian: "London and Pharmacy in the Seventeenth Century," illustrated by lantern slides.

Oil and Colour Chemists' Association, London: Manson House, 26 Portland Place, W.1. 7 p.m. C. Whalley: "Microanalysis in the Oil and Colour Industries."

FRIDAY, JANUARY 14

Royal Institute of Chemistry (Midland Chemists' Committee). University, Edmund Street, Birmingham, 6.30 p.m. G. H. Osborn: "Recent Developments in the use of Organic Reagents in Chemical Analysis."

The Chemical Society, Newcastle and Durham (chemistry department). King's College, Newcastle-on-Tyne, 5 p.m. Bedson Club lecture. Dr. R. Spence: "Chemistry and Atomic Energy." Aberdeen: Joint meeting with Royal Institute of Chemistry and Society of Chemical Industry, chemistry department, Marischal College, 7.30 p.m. R. Belcher: "Sulphide Precipitation and the Law of Mass Action."

Oil and Colour Chemists' Association, Manchester Engineers' Club, 6.30 p.m. J. Glassman: "Some Theoretical Considerations of Azo-Pigment Chemistry."

Institute of Rubber Industry, Leicester College of Technology, 7 p.m. Lecture on Plastics.

SATURDAY, JANUARY 15

British Interplanetary Society, St. Martin's School, 107 Charing Cross Road, W.C.2, 6 p.m. "The Problem of Interplanetary Flight" (Part 2). L. R. Shepherd: "The Application of Nuclear Energy."

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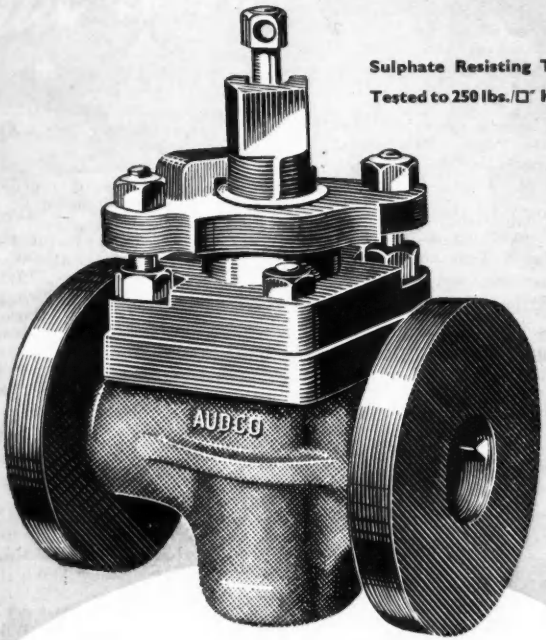

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Patent Processes in Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted will be obtainable, as soon as printing arrangements permit, from the Patent Office, Southampton Buildings, London, W.C.2, at 1s. each. Higher priced photostat copies are generally available.

Complete Specifications Accepted

Chlorinated methypolysiloxane resins.—British Thomson-Houston Co., Ltd. May 5, 1945. 611,494.

Treatment of chloromethyl-substituted polysiloxanes. — British Thomson - Houston Co., Ltd. May 5, 1945. 611,495.

Sulphurised oils.—J. C. Arnold. (Standard Oil Development Co.) May 2, 1946. 611,501.

Oxygen liberating compositions and method of making the same.—Mine Safety Appliances Co. Aug. 24, 1944. 611,587.

Bleaching processes.—I.C.I., Ltd. May 4, 1945. 611,589.

Manufacture of laminated materials.—Bakelite, Ltd., N. W. Knewstubb, and C. N. Jenkins. May 6, 1946. 611,592.

Manufacture of primary amines.—H. F. Oxley, E. B. Thomas, and F. S. Nichols. May 6, 1946. 611,593.

Boron-containing molybdenum steel.—United Steel Co., Ltd., and W. E Bardgett. July 18, 1946. 611,598.

Formamide derivatives.—Roche Products, Ltd., A. Cohen, and J. A. Silk. Aug. 24, 1946. 611,600.

Process and furnace for the manufacture of glass.—Soc. Anon. des Manufactures des Glaces et Produits Chimiques de St.-Gobain, Chauny & Cirey. March 29, 1945. 611,401.

Production of olefinic nitriles.—American Cyanamid Co. Sept. 19, 1939. 611,303.

Roofs for industrial furnaces.—Osterreichische Magnesit A.G. April 19, 1938. 611,704.

Process and apparatus for the wet separation of solid particles from loose masses.—Werf Conrad N.V. Jan. 16, 1939. 611,605.

Apparatus and process for the manufacture of industrial and power gases.—M. Steinschlaeger. July 28, 1943. 611,607.

Production of aqueous emulsions of polyvinyl compounds.—Vinyl Products, Ltd., J. E. O. Mayne, and H. Reichard. Oct. 18, 1943. 611,904.

Alkylation of isoparaffins.—Anglo-Iranian Oil Co., Ltd., A. P. Shearer, and T. Cubin. Jan. 31, 1944. 611,905.

Methods of and apparatus for electrolytically cleaning or descaling the internal surface of a hollow metal article, such as the internal surface of a hollow metal valve. Thompson Products, Inc. April 9, 1943. 611,610.

Separation of iron ores.—American Cyanamid Co. April 10, 1944. 611,906.

Treatment of polysulphide polymers.—Thiokol Corporation. Sept. 14, 1943. 611,612.

Refining of hydrocarbons.—Anglo-Iranian Oil Co., Ltd., L. C. Straug, and J. Owen. Oct. 16, 1944. 612,006.

Sulphonamides and preparation thereof. —General Printing Ink Corporation. March 11, 1944. 611,716.

Recovery of chlorine values from by-product hydrogen chloride.—Westvaco Chlorine Products Corporation. April 7, 1944. 611,908.

Preservative composition and its use for preserving pellicles of regenerated cellulose.—Viscose Development Co., Ltd. May 11, 1944. 612,008

Method of and apparatus for separating oil from animal material.—W. W. Triggs. (Aquacide Co.) May 18, 1945. 611,614.

Manufacture of dyestuff mixtures.—Soc of Chemical Industry in Basle. May 24, 1944. 612,009.

Continuous-flow retorts for carbonising solid fuels, to produce gas rich in hydrogen. —Compagnie Generale de Construction de Fours. Feb. 25, 1941. 611,721.

Method of purifying sols.—National Aluminate Corporation. Oct. 26, 1944. 611,914.

Production of foam generating compositions.—Wormald Bros. Pty., Ltd. Oct. 20, 1944. 612,011

Process for the synthesis of vinyl chloride.—Solvay & Cie. Jan. 21, 1943. 611,915.

Mixing chamber for use in heating or cooling devices.—H. S. Wheller. Oct. 9, 1945. 612,012.

Removal of sulphuretted hydrogen from gases.—R. Walker, C. R. Wilkin, H. G. Cooper, and J. T. Brown. Nov. 5, 1945. 611,917.

Process for the manufacture of valuable reaction products of high-molecular unsaturated substances containing more than one unsaturated grouping in the molecule with inorganic acids or acid anhydrides.—N.V. de Bataafsche Petroleum Maatschappij. Dec. 23, 1941. 611,919.

Process for the removal of impurities of an organic nature from aqueous liquids by means of resin gels.—Meijer's Dextrinefabrieken, N.V., O.J. Dec. 3, 1942. 611,920.

Production of fibres, particularly glass fibres.—Soc. Anon. des Manufactures des Glaces et Produits Chimiques de St.-Gobain, Chauny & Cirey. May 20, 1943. 611,623.

Process for gas generation from solid carbonaceous material.—Standard Oil Development Co., and C. Arnold. Feb. 14, 1946. 611,924.

What is ION Exchange?

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between a liquid and a solid !

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of undesirable impurities from solutions.

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of reactions by insoluble acids.

5 SUBSTITUTION
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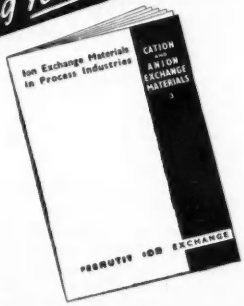

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Production of phenanthridine compounds.—May & Baker, Ltd., and H. G. Barber. Feb. 27, 1946. 611,745.

Condensation of zinc from its vapour in gaseous mixtures.—National Smelting Co., Ltd., and S. Robson. March 12, 1946. 611,928, 611,929 611,936.

Making of glass fibres.—Glass Fibers, Inc. Dec. 11, 1945. 611,630.

Hydraulic press plant.—Precision Developments Co., Ltd., G. Olah, and F. J. Box. March 23, 1946. 611,632.

Manufacture of composite materials containing hydrocarbon copolymers and bituminous materials.—J. C. Arnold. (Standard Oil Develpment Co.) May 2, 1946. 611,642.

Melting zinc dust.—New Jersey Zinc Co. Dec. 21, 1945. 611,643.

Apparatus for spraying travelling materials.—J. O. Martin, and D. M. Martin [trading as W. & J. Martin], and W. R. Gaythwaite. May 2, 1946. 611,644.

Apparatus for heating insulating material by subjecting it to a high-frequency field of electric force.—British Insulated Callender's Cables, Ltd., J. C. Quayle, and P. Jones. May 2, 1946. 611,645.

Heating plant.—Babcock & Wilcox, Ltd., and E. L. Luly. May 3, 1946. 611,659.

Production of cellulose esters.—British Celanese, Ltd. May 3, 1945. 611,665.

Process of preparing lactic aldehyde.—C. S. Dillon. May 6, 1946. 611,674.

Quaternary ammonium compounds and the treatment of textile materials therewith.—I.C.I. Ltd., E. S. Lane, A. Lowe, and J. A. Moyse. May 6, 1946. 611,682.

Detergent compositions.—I.C.I., Ltd., W. Baird, E. G. Parry, and T. E. Thompson. May 6, 1946. 611,683.

Polishing, grinding and like machines.—J. E. Randall, and R. G. Forbes. May 6, 1946. 611,685.

Apparatus for loading and conveying materials.—C. H. Rhodes. May 8, 1946. 611,784.

Vat dyestuff.—I.C.I., Ltd., and F. Irving. May 8, 1946. 611,786.

Process for improving the physical characteristics of vinyl resin filaments, threads, yarns and the like.—Carbide & Carbon Chemicals Corporation. June 7, 1945. 611,796.

Production of metal-metal oxide compositions or alloys.—Mallory Metallurgical Products, Ltd. July 28, 1945. 611,813.

Process for attaching threads, tissues, and the like of cellulose in native or regenerated condition to rubber.—N.V. Onder-Zoekingsinstitut Research. Sept. 15, 1945. 611,825.

Treatment with resinous polymers of fibrous materials consisting wholly or partly of wool.—Wolsey, Ltd, and P. Alexander. May 9, 1946. 611,828.

Treatment of textile fibrous materials with vinyl compounds.—Wolsey, Ltd., and P. Alexander. May 9, 1946. 611,829.

Process for the emulsion polymerisation of vinyl compounds.—Wolsey, Ltd., and P. Alexander. May 9, 1946. 611,830.

Manufacture of organo-siloxanes.—Corning Glass Works. Feb. 26, 1942. 611,700.

Production of chlorinated heterocyclic compounds.—E. I. Du Pont de Nemours & Co. May 12, 1945. 611,851.

Production of aqueous dispersions.—I.C.I., Ltd. May 10, 1945. 611,852.

Process for degreasing hides and skins.—I.C.I., Ltd., and K. McLaren. May 10, 1946. 611,853.

Means for stripping ingots from moulds.—Butterley Co., Ltd., and A. G. Westmoreland. May 13, 1946. 611,884.

Liquid-level indicators.—C. N. Vallon. May 13, 1946. 611,890.

Liquid spray nozzles.—Barber, Wilsons & Co., Ltd., and C. O. Wilson. May 13, 1946. 611,901.

Rotating sintering apparatus.—O. Rolfsen. April 21, 1941. 611,955.

Methods of making cellular thermoplastic sheet material and receptacles made therefrom.—United States Rubber Co. June 28, 1944. 612,023.

Method of feeding pieces of glass material to a moulding machine.—Moss Glasvaerk A/S. June 4, 1941. 612,033.

Processes for the production of metal from oxide ores.—Soc. Française de Charbonnages du Tonkin. March 27, 1944. 611,800.

Eye guards or shields.—D. H. G. Winckles. May 16, 1946. 612,042.

Treatment of fabrics containing thermoplastic cellulose derivative filaments or fibres.—British Celanese, Ltd. June 7, 1945. 612,055.

Ethylene polymers and co-polymers.—J. Downing, and M. H. Wilcox. May 16, 1948. 612,056.

Welding electrodes and welding nickel-chromium or nickel-chromium-iron alloys.—Mond Nickel Co., Ltd. June 2, 1945. 611,802.

Synthetic fuel and process of manufacturing the same.—N. A. Stewart. May 17, 1946. 612,062.

Method of producing translucent and opaque polymeric material.—I.C.I., Ltd., T. Downing, and W. E. F. Gates. May 17, 1946. 612,070.

Extraction and purification of streptomycin.—Wellcome Foundation, Ltd., and T. J. Woodthorpe. May 27, 1946. 611,984.

Catalysts.—I.C.I., Ltd., and P. W. Reynolds. May 29, 1946. 611,987.

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Impregnating compositions.—Bakelite Corporation. June 8, 1945. 611,990.

Production of heterocylic substituted phenacylpyridines.—American Cyanamid Co. June 9, 1945. 611,991.

Tubes made of indiarubber or other similar materials.—Produits du Lynx Jaune Soc. A. R. L. Nov. 25, 1938. 611,997.

Flexible extensible and compressible tubes or pipes.—Produits du Lynx Jaune March 22, 1946. 611,998.

Grinding and/or polishing machines.—Impregnated Diamond Products, Ltd., and G. Fefer. June 11, 1946. 611,999.

Alloys for high-temperature use.—Haynes Stellite Co. June 13, 1945. 612,001.

Mountings for thread guides.—American Viscose Corporation. Sept. 7, 1945. 612,071.

Methods of producing high vacua.—British Thomson-Houston Co., Ltd. June 28, 1945. 612,073.

Washing of minerals and ores.—I.C.I., Ltd., A. Rateliffe, and G. W. Talbot. June 27, 1946. 612,075.

Separation of amino acids.—C. M. Armstrong, Inc. Nov. 19, 1942. 612,077.

Coloration of yarn or fabrics composed wholly or partly of secondary or acetone-soluble cellulose acetate.—T. E. Marchington & Co., Ltd., and G. D. Sutton. July 3, 1946. 612,078.

Method of drying material in paste form.—Volund A/S, and J. Brabaek. Sept. 17, 1946. 612,090.

Processes of and apparatus for depositing metals on a support by thermal evaporation in a vacuum.—P. Alexander. Oct. 1, 1946. 612,093.

Method and apparatus for producing a series of die cast articles.—Crown Fastener Corporation. Sept. 29, 1942. 611,702.

Method of forming and trimming die castings.—Crown Fastener Corporation. Aug. 15, 1942. 611,703.

Home News Items

Campaigning Against the Steel Bill.—Mr. Alfred Edwards, M.P., who returned from America last week, opened his campaign against the Iron and Steel Bill with a meeting in Middlesbrough.

2000 Houses for Alkali Workers.—The erection of 2000 houses for workers brought into the district by I.C.I. Alkali Division, which is extending its works, is part of a large development plan produced by the Cheshire county authorities.

Lancashire River Pollution Suspected.—Large numbers of fish, left by the tide at Fleetwood, are believed to have been poisoned by pollution in the River Wyre. Sacks of the fish and water samples have been taken by local fishery officers.

Change of Address.—Wild-Barfield Electric Furnaces Ltd., announce that the address of their Sheffield office and that of their associates Messrs. G. W. B. Electric Furnaces, Ltd., is now 4 Paradise Square, Sheffield, 1. (Telephone: Sheffield 22776.)

Deep Coal Seams Survey.—As a result of investigations made during the year by Dr. A. A. Woodland of the Geological Survey, the South-Western Regional Coal Board announced that there are prospects of securing millions of tons of coal between Tondu, near Bridgend, and Port Talbot.

Fire at B.A.C.—The British Aluminium Co., Ltd., whose Latchford Locks Works was recently the scene of a fire, reported in THE CHEMICAL AGE, writes that the fire was not associated with either magnesium or aluminium powder, as our report stated. Neither of those metals are kept in the buildings where the outbreak—a minor one—occurred.

Filaments from Petroleum.—The prospect of producing almost indestructible brush bristles derived from petroleum products, was discussed by Miss Elsie Davies, principal of a firm of lubricating oil merchants, speaking to the Liverpool branch of the Institute of Export last week. She drew attention also to the experiments in hand for the production from the same source of a thread of the nylon type with great tensile strength.

I.C.I's Tear Gas.—Permission has been granted Imperial Chemical Industries, Ltd., to store in a disused quarry at Warton, North Lancashire, surplus war stock of 11,000 steel cylinders containing tear gas held by the company, to be used primarily in the manufacture of an anti-malarial drug. The company originally wanted to store the cylinders on Hulme Park Fell, in Westmorland, and appealed unsuccessfully against the refusal of the South Westmorland Rural Council to allow storage there.

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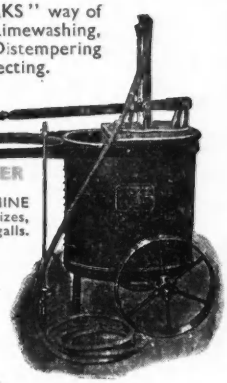

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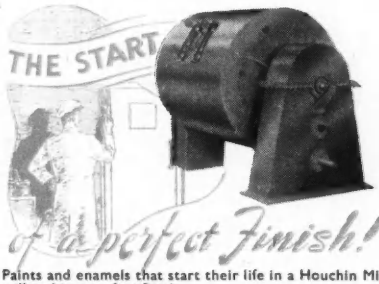

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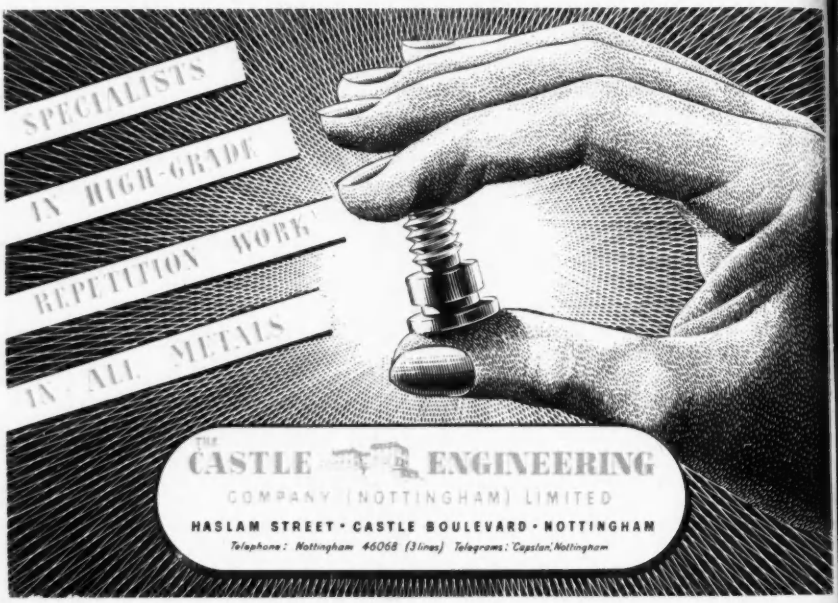

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